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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 35

Application Number: 09/372,560
Filing Date: August 11, 1999
Appellant(s): VANCURA, OLAF

Arthur Steiner
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 2/24/03.

Notice to the Board of co-pending applications 10/189,721 currently issued a non-final office action as of 1/17/2003 and 09/372,560, also currently on appeal. These applications contain similar issues and arguments and are brought to the attention of the Board so that it may handle these cases as a group if it is deemed more efficient.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

Appellant's brief includes a statement that claims 1, 2 and 4-18; claims 19-24; claims 25-30; claims 42-55, 57 and 58; and claims 130-132 do not stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

5718429	Keller, Jr.	2-1998
GB 2,197,974	Evans	6/1988
5,178,545	Thompson	1/1993
6,193,606	Walker	2-2001
GB 2,262,642	Claypole	6/1993

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

Claims 1, 2, 4-30, 42-47,49-55, 57 and 58 are rejected under 35 U.S.C. 102(e) as being anticipated by Walker.

As to claims 1, 2-4, 12, 13, 19, 20, 25-30, 42, 43-47, 50, 51, 57 and 58, Walker clearly shows the wager, game of chance and trivia game. He discloses his play of the trivia game to occur "while the reels are spinning" (col. 3, ln. 26). Such is considered to be "separate" from the play of the game of chance. Claims 9-11, 48,

49 and 56 are inherent since a game designer must determine and be aware of the "desired profitability" of the game he is designing. Scarne's Complete Guide to Gambling discusses house percentage and how a gaming operator would make or loose money by making determinations that affect house percentage (conventionally the house pays off a wager at less than the correct odds. A favorable house percentage that considers the level of skill of the players (i.e. the correctness of the answers) is inherent. See discussion in the paragraph below and in response to applicant's invention, he has the variables of the known wagering game as well as the skill of the player. It is obvious in game of skill that a smarter player reduces the house advantage (such also occurs with the game of black jack that has an element of skill). Obviously a house would want to protect themselves from the "smarter" player and design the house percentage such that no money would be lost. If such was the case then the "smarter" player could "play the house percentage" and always make money from the house. Such weaknesses in a casino game where players may be able to always win money are inherent in the design of a game. Applicant bases the allowability of his claims on what he considers his "discovery" in allowing a house to always make money on a wagering trivia game. This is set forth at the top of pg. 9 of his specification as quantified in a formula having all the known variables in the designed game. Merely expression what is inherent in the art as a formula is not a patentable advance.

Claims 1, 2, 4, 9-30, 42-47,49-55, 57 and 58 are rejected under 35 U.S.C. 102(b) as being anticipated by 2,262,642.

As to claims 1,2,4, 12, 13, 19, 20, 25-30, 42-47, 50, 51, 57 and 58, shown is a slot 10 for receiving a wager, a casino slot machine and a trivia game (discussed on the bottom of his page 3) that is played separate and after the casino game. A favorable house percentage that considers the level of skill of the players (i.e. the correctness of the answers) is inherent. See discussion below in response to applicant's remarks made in the preliminary amendment. In line with this claims 9-11, 48 and 49 are inherent since a game designer must determine and be aware of the "desired profitability" of the game he is designing. Scarne's Complete Guide to Gambling discusses house percentage and how a gaming operator would make or loose money by making determinations that affect house percentage (conventionally the house pays off a wager at less than the correct odds. However, the rules of play, such as a "push" or allowing the determination of a players hand in blackjack before the determination of the dealer can also affect the house percentage). Inherently all gaming operators avoid loosing money. Clearly no operator of the '642 method would consider loosing money. One must consider such is a matter of common knowledge and common sense of the person of ordinary skill in the art to consider the level of skill of a player as a variable in the conventional house percentage of the combined wagering game. (See In re Bozek, 416 F.2d 1385, 1390, 163 USPQ

545, 549 (CCPA 1969)) Note 2,253,569 at the bottom of pg. 2 that shows that one skilled in the art of trivia game is concerned with "loss of income from Skill with Prize machines due to over-skilful players..." Knowing that the over skilled player can result in a loss of income is considered to be part of the skill that is presumed on the part of those practicing in the wagering machine art. See In re Sovish, 769 F.2d 738, 743, 226 USPQ 771, 774 (Fed. Cir. 1985). In evaluating a reference, it is proper to take into account not only the specific teaching of the reference(s) but also the inferences which one skilled in the art would reasonably be expected to draw therefrom. In re Preda, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968). In the instant case, the consideration of house percentage, so that a game makes money without decreasing player interest, is at the root of every wagering game. Additionally, one must observe that an artisan must be presumed to know something about the art apart from what the references disclose (see In re Jacoby, 309 F.2d, 513, 516, 135 USPQ 317, 319 (CCPA 1962). Clearly, an artisan would realize that a favorable house percentage would have to be designed for a game to make money in a casino environment. Claims 14-18, 21-24 and 52-55 are drawn to quiz games. Examiner submits that such gaming formats are old and well known and inherent in the disclosure of '642.

Claims 1, 2, 4-7, 12, 13, 18, 42-46, 50, 55, 57 and 58 are rejected under 35 U.S.C. 102(b) as being anticipated by Keller and, in the alternative 2,197,974.

Claims 1, 2, 4, 42-46, 50, 57 and 58 are clearly shown. In Keller, a player places a wager and receives a payout in tokens like a standard casino game. However, the tokens are not given any cash value and are only good for chances to play the game of skill. Specifically turning to claim 1, the steps of "receiving a wager" are shown in fig. 1 of Keller by "players can place stake in a casino game", "playing an underlying game of chance" is shown by "conduct casino game" and "playing a knowledge-based bonus game." by "conduct skill game. The house advantage is at the bottom of col. 2, lns 61-67 where a player is played "for the entertainment". The house advantage is nothing more than a percentage of the wager retained by the house for the privileges of playing the games. In view of the above, Keller meets the limitations of the claims. In Keller and '974, the game of chance stops when a prize has been determined or rewarded. At that point, the game of skill commences. As to claim 5, stopping the game of chance when the condition of a prize being identified is shown. As to claim 6, the game of chance stops at the end of the game. The end of each game of chance is considered to be a "given frequency" as called for in claim 7. As to claims 12 and 13, a player is "paid" a prize in Keller and '974. Claims 18, 41 and 55 are shown in that a player is paid a first prize if correctly answers and receives a second amount of no prize if incorrectly answers

Claim Rejections - 35 USC § 103

Claims 8-11, 14-17, 19-30, 47- 49, 51-54, 56 and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Keller and/or 2,197,974 in view of Thompson.

As to claims 8 and 47, neither of the above references show random stopping of the chance game. Thompson teaches that it would have been obvious to random conduct the steps of a game like those shown by Keller and '974 in order to add an element of surprise to the players. The setting of the house advantage in claim 9-11, 19, 20, 25-30, 48, 49 and 56 are obvious matters of design choice. As to claims 14, 21 and 22, it is considered an obvious matter of design choice to require either an exact answer or a proximate answer that is "close enough". Similarly, allowing a player to have more than on chance to answer a query and paying out accordingly as called for in claim 63 is old and not considered an advance in the art. To have only required a proximate answer in Keller of '974 would have been obvious in order to make it easier on the player. As to claims 15-17, 23 and 51-54, Keller and '974 show "trivia" and a "quiz". Multiple choice, puzzles and true/false questions are all well know examples of such trivia or quiz type games of skill that are known in the art and to have selected one would have been an obvious matter of design choice. Claim 24 is shown in that a player is paid a first prize if correctly answers and receives a second amount of no prize if incorrectly answers.

Claims 130-132 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walker, 2,262,642, Keller and 2,197,974 as set forth in the claim above further in view of matters well known to mathematics and gaming.

The above applied references fail to discuss the house percentages claimed. The house percentage in chance game such as slots relates to mathematics well known to one skilled in the art of gaming. When a "basic game" is combined with a "secondary game", the mathematics of each game are considered synergistic. It would be routine for one skilled in the art to either determine the house percentage or design the game to a specific house percentage or range. As such to have designed the house percentages as called for in claims 130-132 is considered an obvious matter of design choice in order to set the profit desired by the house.

(11) Response to Argument

1. Rejection of claims 1, 2,4-30,42-47,49-55,57 and 58 under 35 USC 102 to Walker.

With respect to claim 1, the Board must recognize and consider the state of the art. Currently popular in the gaming "slots" gaming industry is the combining of a first primary game of chance, such as a slot machine or a video poker machine, with a secondary "bonus" game in which a player is allowed to play, or enter into, the bonus game upon a predetermined event occurring in the primary game. See U.S. Patents to Thomas 6,190,255, Perrie 6,173,955 and Marnell 5,393,057. More importantly is **Walker** 6,193,606 who "combines" a chance game with a trivia game. The "condition" that triggers the play to be switched from the primary game to the bonus game ranges from a predetermined event, amount wagered, a random event and/or even a set amount of time.

Claim 1 is drawn to this type of game where the secondary "bonus" game is a trivia game. Claim 1 calls for playing the knowledge based game "when a bonus condition occurs in the underlying game". In Walker the spinning of the reels is considered to be the bonus condition when a player plays the knowledge-based game. In Walker, a player spins the reels and then he subsequently plays the knowledge-based **"after playing the game of chance"**. Whether or not a the reels must stop spinning or that the player has received a payment is not distinguished by any limitations in the claims. Known is that Office personnel are to give claims their broadest reasonable interpretation in light of the supporting disclosure. In re Morris, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Here there is no limitations in the claim that prohibit the examiner from interpreting playing the knowledge based game "after" the reels have been spun to meet the limitation of "after playing the game of chance. As to the house advantage, in Walker, a player can access higher reward levels with the slot machine if successful at the trivia game. Well known and considered inherent in the design of casino games is the consideration of house percentage. As set forth in the grounds for rejection, the consideration for a house percentage is rudimentary to the design of wagering games. Clearly the games are designed to make money for a casino operator and not to lose money. The Board should find appellant's position and arguments with respect to the house percentage incredible since he himself , Olaf Vancura, writes in his book Smart Casino Gambling that, "now the casino, for almost all games, enjoys a positive expectation" (pg. 33, ln. 7). A copy of this book pgs. 23-33 is appended to this Answer for reference by the Board. Upon reading this section of the Book the Board will find how the appellant must feign ignorance with respect to the notorious nature of house percentage and its play in the design of casino games. Also appended is pgs. 40-43 of "Managing Casinos" that further shows the well known nature of "The Concept of House Advantage. Lastly, while it may be overkill on the point, pgs. 103-125 and 213-225 of "Casino Operations Management" is further include so that the Board can fully appreciate that appellant has contributed nothing to the consideration of house percentage in the

design of casino games. In view of this material, it can be seen where any argument that the house percentage is not known or would not be considered in the design of a game presumes stupidity on the part of one in the art rather than skill. See In re Sovish, 226 USPQ 771, 769 F2d 738. With that, Walkers game would clearly be impractical if it allowed a player to access higher rewards that exceeded that amount of money wagered by a player. Upon review of the level of ordinary skill in the art indicated by the appended copies, one can see that the house percentage is always set within a predetermined range depending upon the profit desired. As well recognized and articulated by "Managing Casinos" on pg. 42, ln. 29 is "how important it is to have the 'right' mix...A small house advantage will not cover costs, and a strong house advantage will pummel the clientel, and they will not return nor will anyone else visit after the word gets out" (emphasis added). In short, the profitability of casino games is inherent in their design, conception and implementation and there exists on clear error on the part of the examiner. As such the Board is asked to sustain this grounds for rejection.

Appellant is incorrect in statement that the examiner failed to specifically identify each feature in the claimed invention. The rejection set forth that;

> As to claims 1-4, 12, 13, 19, 20, 25-30, 42, 43-47, 50, 51, 57 and 58, Walker clearly shows the wager, game of chance and trivia game. He discloses his play of the trivia game to occur "while the reels are spinning" (col. 3, ln. 26). Such is considered to be "separate" from the play of the game of chance. Claims 9-11, 48, 49 and 56 are inherent since a game designer must determine and be aware of the "desired profitability" of the game he is designing. Scarne's Complete Guide to Gambling discusses house percentage and how a gaming operator would make or loose money by making determinations that affect house percentage (conventionally the house pays off a wager at less than the correct odds. A favorable house percentage that considers the level of skill of the players (i.e. the correctness of the answers) is inherent. See discussion in the paragraph below and in response to applicant's remarks made in the preliminary amendment.

Clearly shown is 1. the bonus condition as "He (Walker) discloses his play of the trivia game to occur "while the reels are spinning" (col. 3, ln. 26). Further with respect to 2. and providing separate payoffs. Such is shows "Such (the trivia game) is considered to be "separate" from the play of the game of chance". In Walker a player receives a payoff from the slot game regardless of the trivia game. He receives separate "higher reward levels" with a trivia answer as shown in fig. 9 at 960 than without as shown at 950. These payouts 950 and 960 are considered to be "separate" and given "regardless" of the knowledge-based game. With respect to appellant point 4, the predetermined range was taken in the grounds for rejection to be inherent in casino games. Note that the Board is asked to give deference to the examiner's conclusion as set forth in In re Berg, 65 USPQ2d 2003 (Fed. Cir. 2003). The appellants have not pointed to any clear flaw in the reasoning of the examiner on this issue, nor have they

pointed to any evidence of record indicating that the findings of the examiner on this issue are unsupportable. In Berg, it was held that as persons of scientific competence in the fields in which they work, examiners are responsible for making findings, informed by their scientific knowledge, as to the meaning of prior art references to persons of ordinary skill in the art and the motivation those references would provide to such persons. Absent legal error or contrary factual evidence, those findings can establish a prima facie case of obviousness. In this case, the appellants have not pointed to any legal error affecting the Board's obviousness analysis. Nor have they pointed to sufficient factual grounds, either in the record or in any judicially noticeable sources, to question the findings made by the examiner and the Board as to the teachings of the prior art and the motivation that the prior art references would give to a skilled artisan to make the claimed invention. While appellants point is unclear, it appear that he asks the Board to reverse the rejection because he fells that the examiner fell short of clearly articulating his position or erred by failing to address a limitation. However, this is not a basis for patentability and the Board is asked to sustain the grounds of rejection as set forth above.

In the middle of pg. 9, appellant merely restates his previous argument and no further comment is deemed necessary. At the bottom he takes fails makes the broad statement that "inherency is of no avail". However, such an argument does nothing for the appellant to met his burden to prove that the prior art products do not necessarily or inherently possess the characteristics of his claimed product invention. In re Fitzgerald, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)).

At the bottom of pg. 9, appellant first asserts that the examiner has not "proffered any factual basis to justify" his rejection and then accuses the examiner in the middle of pg. 10 of using "six different references" which were offered to appellant to support the examiner's findings of inherency. He quickly dismisses these references as being "irrelevant". All that can be gleaned from this argument is that the examiner clearly did in fact meet his burden required in relying upon the theory of inherency to provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990). As in Fitzgerald, once this has been done the burden shift to the appellant to prove that the prior art products do not necessarily inherently posses

the characteristics of the claimed product. It is submitted that this has not been done in the Brief or in the prior record and one this basis alone the Board is asked to sustain the grounds for rejection.

Claim 19

Appellant's arguments amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

Walker clearly shows receiving a wager at 364, playing the casino game by adding money to 364, stopping from adding money to spin the reels, paying a player in the casino game of chance as shown in fig. 9 at 950 and playing the knowledge-based game after the money has been added and the bonus condition of spinning the reels occurs. The knowledge-based game of Walker provides and inquiry to the player as shown in fig. 3B, receives and answer a-d and paying the player based on the answer as shown in fig. 9 at 960. A player is paid as shown at 950 regardless of the trivia game and there exist no intervening game. During patent examination, the pending claims must be "given their broadest reasonable interpretation consistent with the specification." In re Hyatt, 211 F.3d 1367, 1372, 54 USPQ2d 1664, 1667 (Fed. Cir. 2000). Hence, based on such an interpretation of Walker as further clarified above, the Board is asked to sustain the grounds for rejection.

Claim 25

Claim 25 broadly recites that the knowledge-based game is played when "a bonus condition occurs". There is no limitations in the claims that restricts the nature of what can be considered a bonus condition. As such, the examiner has considered the bonus condition to be the "spinning of the reels". In Walker a player is allowed to enter into the knowledge-based game while the reels are spinning. He further provides a payoff regardless of the outcome of the knowledge based game as can be shown at 950 of fig. 9. Lastly, the house percentage has been set forth as inherent to casino game such as that shown by Walker. Since all of the limitation are considered shown by Walker, the Board should sustain this grounds for rejection.

Claim 42

In claim 42, specifically calls for providing a game of chance374, paying the player when a winning combination results as shown in fig. 9 at 350, providing a knowledge-based game as shown in fig. 3B and stopping the insertion of money when the bonus condition of spinning the reels occurs, playing the knowledge-based game. The player is paid regardless of the outcome of his answers to the knowledge-based game as shown in fig. 9 at 350 and the house advantage is inherent to casino game such as that shown by Walker.

2. Rejection of claims 1,2,4,9-30,42-47,49-55,57 and 58 by Claypole

Appellant's interpretation of Claypole on pg 14 is noted. On pg. 15, appellant's initial arguments amount to a mere allegation of patentability . In Claypole she clearly shows a game machine which has a payoff from which the first game of chance is paid off independently. Note on pg. 12, ln. 5 where she states that, "for any winning combination of symbols, the player may simply collect the amount won using the collect button". This meets the limitations set forth in appellant's claims. In accordance with the claimed invention, there are no particulars as to what one would consider to be an "intervening game". Even upon review of the specification in order to determine their scope of such terminology no specific meaning is defined. As such the term intervening game should not be accorded any meaning different from the usual and customary meaning of the claim terms. In Claypole she shows a game of chance comprising 4 and 21. No other games are disclosed which is consistent with the language of the recited claims. As to the term limitation "without any intervening risks", it is submitted that no such limitation exists in claim 1 and appellant has not been specific as to which limitation he is referring. As such, it can be seen where all of the features of claim 1 are anticipated by Claypole.

Again applicant feigns ignorance of the what is known to one skilled in the art pertaining to house percentage. As can be seen from the evidence appended to this answer, the tendency and ability of one skilled in the art to consider the house percentage when designing a casino game is notorious.

3. Rejection of claims 1,2,4-7,12,13,18,42-46,50,55,57 and 58 under Keller or Evans

For each of the independent claims 1 and 42 casino games are known to have a house percentage within a "predetermined range". This issue has been beat to death throughout this Answer and no further need for elaboration is deemed necessary.

Keller

In Keller the notion of a bonus condition is so broad as to cover almost anything under the sun. As such the successful completion of the game of chance marked by the award of a token to a player is considered to be a "bonus condition triggering a skill game". As with games like Keller's that are intended to be played in Casinos, they are profit motivated. Inherent is that the game will make more money for the casino than it will cost to operate it.

Clearly there is a payoff for success in the underlying game of chance in the token that is rewarded to the player. There are no limitations in the instant claims that restrict what is considered to be a payoff.

Likewise, there is no limitation that restrict what is considered to be a bonus condition. As such the successful completion of the game of chance marked by the award of a token is considered to be a bonus condition.

Moreover, the game of Keller is explicitly intended to be played in a casino where he recites "but which prevents the casino game from being utilized as a game of chance" (col. 1, ln. 44). Since it is a casino game it is considered to have a house advantage where the game operator intends to have more costs when compared to cost out. As to the teaching of Keller referred to at the top of pg. 20, there is no requirement that teachings of the applied art are to be read into the claims. In fact, it is prohibitive to do so.

The "odds" of Keller is confined to the type of games conducted and the prizes awarded. Nothing in appellants claim requires that the "awards" be monetary. Clearly one skilled in that are would recognize that the casino game of Keller would be profit driven. As such it is considered to inherently have a "house advantage within a predetermined range".

Evans

Evans shows that the his game "may be such that in any event a prize will be awarded upon successful completion of the game of skill." (pg. 5, ln. 16). However, in such cases the amount rewarded will be equal to the amount wagered or no prize at all. This is considered to meet appellant's limitation of "awarding a payoff...regardless of the outcome of a subsequent knowledge-based game or any intervening game".

For each of the independent claims 1 and 42 casino games are known to have a house percentage within a "predetermined range". This issue has been beat to death throughout this Answer and no further need for elaboration is deemed necessary.

When an examiner sets forth his position and discusses issues that pertain to a 102 grounds of rejection and the same issues are present and argued within the context of a 103 grounds for rejection, there is nothing erroneous about stating that the claim limitations in view of the prior art are being interpreted consistently in the same way. When it comes to a question of inherency, as is an issue in the instant case, it is recognized that whether the rejection is based on inherency' under 35 U.S.C. 102, on prima facie obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted]." The burden of proof is similar to that required with respect to product-by-process claims. In re Fitzgerald, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980).

4. Rejection of claims 8-11, 14-17, 19-30, 47, 49, 51-54, 56 and 58 upon Keller or Evans in view of Thompson.

In addressing the claim limitations, one must consider when such is a matter of common knowledge and common sense of the person of ordinary skill in the art. (See In re Bozek, 416 F.2d 1385, 1390, 163 USPQ 545, 549 (CCPA 1969)). Moreover, skill is presumed on the part of those practicing in the art. See In re Sovish, 769 F.2d 738, 743, 226 USPQ 771, 774 (Fed. Cir. 1985) and that in evaluating a reference, it is proper to take into account not only

the specific teaching of the reference(s) but also the inferences which one skilled in the art would reasonably be expected to draw therefrom. In re Preda, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968). In considering whether something is a patentable advance or merely design of a mechanic one must consider the problems solved and any unexpected results obtained. There is no evidence of record that the limitations of claims 15-17, 23 and 51-54 produce any unexpected results or solve any particular problem. For example, Keller and Evans only disclose trivia games in general. For a player to have selected the knowledge-based game skill to be a "multiple choice question" would have been an obvious matter of design choice for a mechanic to chose a well known trivia game format. Likewise, it is clear that a puzzle or a true/false trivia game as called for in claims 16 and 17 would not have solved any particular problem or produced any unexpected results.

Ample Motivation Exists

The word "motivation" or a word similar to "motivation" does not appear in 35 U.S.C. § 103(a). While a finding of "motivation" supported by substantial evidence probably will support combining teachings of different prior art references to establish a prima facie obviousness case, it is not always necessary. For example, where a claimed apparatus requiring Phillips head screws differs from a prior art apparatus describing the use of flathead screws, it might be hard to find motivation to substitute flathead screws with Phillips head screws to arrive at the claimed invention. However, the prior art would make it more than clear that Phillips head screws and flathead screws are viable alternatives serving the same purpose. Hence, the prior art would "suggest" substitution of flathead screws for Phillips head screws albeit the prior art might not "motivate" use of Phillips head screws in place of flathead screws. As with the instant case, the prior art suggest "trivia" games. The substitution well known trivia games is considered prima facie obvious.

As set forth in In re Sovish, 226 USPQ 771, 769 F2d 738 there is a great quote about the skilled worker:

Finally, appellants contend that even if it were proper to "combine" the references, whatever they may mean by that, they would "neither meet the terms of the appealed claims nor result in a useful device." The question here, however, is not meeting the terms of the claims. The rejection is for obviousness of what is claimed, which involves consideration of the ordinary skill of the art. Appellant is assuming that one of ordinary skill would not appreciate that Keller's and Evan "trivia game" could take on virtual most known form of knowledge-based games. This argument presumes stupidity of one in the art rather than skill.

No evidence of Nonobviousness

As previously set forth, the applications of house percentage to wagering games are well known to one skilled in the art. This is not a problem to the gaming industry. Once again, the Board can plainly see from "Smart Casino Gambling", "Managing Casinos" and "Casino Operations Management" that the house percentage is a concept deeply rooted in the public domain of the prior art. A house or a casino is no going to host a game that is not viable to profit. There is no evidence that any problems ever existed with respect to calculating a house percentage the appellant has now solved. Merely applying logic, skill and mathematics known to one in the art is not indicative of invention. Not that one must consider matters of common knowledge and common sense of the person of ordinary skill when they are faced with the design of a casino game (See In re Bozek, 416 F.2d 1385, 1390, 163 USPQ 545, 549 (CCPA 1969)) and that skill is presumed on the part of those practicing in the art. See In re Sovish, 769 F.2d 738, 743, 226 USPQ 771, 774 (Fed. Cir. 1985). Additionally, one must observe that an artisian must be presumed to know something about the art apart from what the references disclose (see In re Jacoby, 309 F.2d, 513, 516, 135 USPQ 317, 319 (CCPA 1962).

If in fact, others have attempted to apply a favorable house percentage to a wagering game and failed, there is no evidence in the record of such that has been presented that would overcome examiners recognition or house percentage as being inherent in casino games.

The declaration of Mr. Grochowski is subjective and fails to set forth facts. All statements are in his "belief" or "surprising" to him. While an expert's opinion carries some weight, it does not carry enough weight to overcome the grounds for rejection above.

Likewise the declaration of Gushin merely states that he has never seen a game like "Ripley's Casino Game". Such is an opinion based on experience and not a matter of fact.

The Declaration fails to present facts

The Affidavit or Declaration Under 37 CFR 1.132 of Olaf Vancura is insufficient in that it only refers to the invention and not to the claims. Further it merely draws conclusions that are unsupported by facts. These opinions of the inventor himself at best give a little more understanding of the invention. Well know is that the arguments of counsel, or even the inventor himself, cannot take the place of evidence in the record. In re Schulze, 346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965).

Lastly, Vancura is well recognized and respected for his expertise in the gaming industry. For him to make statements like, "I surmise that game designers never understood how to ensure commercial viability..." are void of fact and avoid acknowledging the level of ordinary skill in the art. Again the Boards attention is drawn to the level of skill as indicated in the sample references appended to this Answer.

Remarkably in the declarations, it is recognized that applicants who allege they discovered the source of a problem must provide evidence substantiating the allegation, either by way of affidavits or declarations, or by way of a clear and persuasive assertion in the specification. In re Wiseman, 596 F.2d 1019, 201 USPQ 658 (CCPA 1979) (unsubstantiated statement of counsel was insufficient to show appellants discovered source of the problem); In re Kaslow, 707 F.2d 1366, 217 USPQ 1089 (Fed. Cir. 1983). Examiner's position is that house advantage and the designing of wagering games with it in mind are old and well known to one skilled in the art. Basis for this position is set forth above. Mr. Vancura's status in the field of gaming is well recognized by the examiner. However, this invention does not require "complex mathematics" (referring to function shown at top of pg. 9 of specification). Such is simply a quantification of all that is known and old to the consideration of house percentage in the design of a wagering game. A mere declaration stating that what is old and well known is non-obvious is not sufficient to over come the grounds for rejection. Applicant makes that statement that "until his invention, it was not known how to handle responses based on the knowledge of a player". However, there is no evidence to support such a statement. The contrary is true supported by 2,253,569 that discusses how to "handle" the "over-skilful players" at the bottom of his pg. 2. While Mr. Vancura's statements are regarded well they amount to what one skilled in the art would have considered when facing the problem of setting a house percentage in games like those of Walker, Kelly or '642. Hence the examiner's position is that applicant has done nothing more than what would have been obvious to one skilled in the art considering making his game profitable and defining a house percentage.

3. Commercial Success Not Shown

There is no evidence that "Ripley's Believe It or Not" has achieved popularity based on the claimed invention. Promotions, fads and exposure of the game all affect a players perception of the game. The fact is that the articles of "Best of Slots 2002" and "Strictly Slots" never mention that the games are successful due to their ability to achieve a favorable house percentage. Hence, lacking a nexus to the claimed invention, these articles are unpersuasive in overcoming the grounds for rejection.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

WILLIAM M. PIERCE
PRIMARY EXAMINER

Mark S. Graham
Primary Examiner

wp
May 14, 2003

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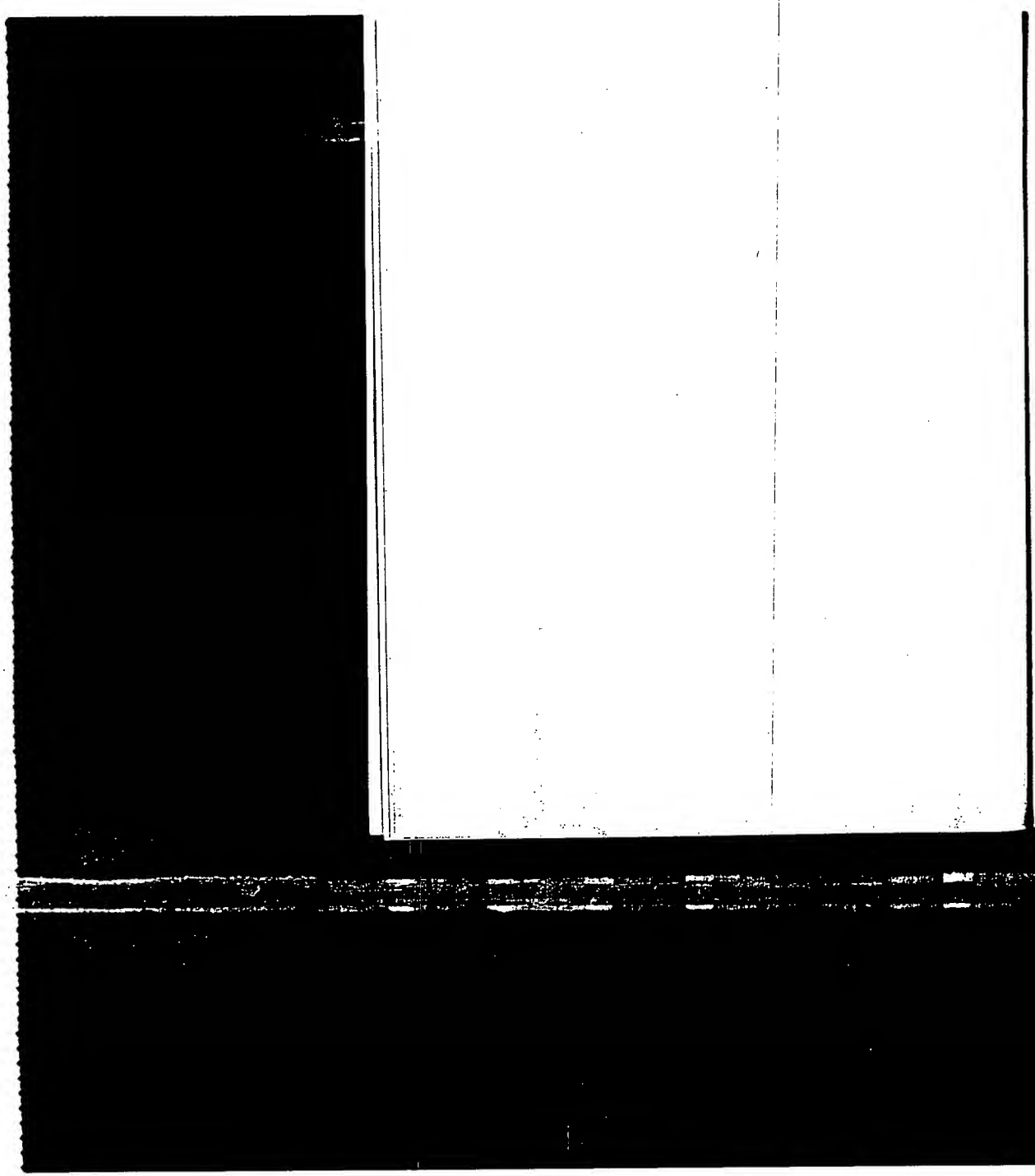
APPENDIX

Smart Casino Gambling

How to Win More and Lose Less

Olaf Vancura, Ph.D.

Index Publishing Group, Inc.
San Diego, California



CHAPTER 2.

How Do Casinos Make Money?

"The mathematics will take care of itself. As long as we (the casino) have an advantage, it's merely a function of time. For an hour, a day, a week, you might be ahead. In the shorter run we might not catch you, but in the long run it's going to happen."

— Phil Flaherty, President/Managing Director, Sheraton Desert Inn, Las Vegas, NV

As we have seen, casinos are extremely profitable propositions. Month after month, seemingly at will, they rake in billions upon billions of dollars. But just how do casinos make these vast fortunes? And how can they be so sure that they won't lose money? The answers to these questions are of fundamental importance for our tour of gaming. In this chapter we'll discuss the mathematical reasons why casinos are virtually assured of making money.

Expectation

Let's first introduce the concept of a player's *expectation*. The expectation, or expected result, is basically a measure of how much the player can expect to lose (or win) based on the total amount wagered. It is generally different for each casino game. If a particular game has an expectation of −10%, this means that, over time, you can expect to lose 10% of the total amount you wager.

For example, consider a hypothetical casino coin flipping game with the following rules. The player bets $1, and the dealer flips a silver dollar. If the coin comes up heads the player wins $1 (from the casino), but if the result is tails the player loses the $1 wager (to the casino). The payout *odds* of this game are 1 to 1. Each time the coin is flipped, there is a 50% chance it will come up heads, with the player winning $1, and a 50% chance of tails, with the player losing $1. Therefore, on average, the player will wind up about even, making the expectation for this game 0%.

However, consider a six-sided die game with the following payouts. If the dealer rolls a 1 or 2, the player wins $1, but if the roll is a 3 through 6, the player loses $1. In this case, since each of the numbers 1 through 6 is equally likely to be rolled, there is a one-third chance of rolling a 1 or 2, thereby winning $1. However, there is a two-thirds chance of getting a 3, 4, 5, or 6 and losing $1. Thus, one-third of the time the player will win $1, while two-thirds of the time the player will lose $1. Mathematically, for a bet of one unit, we may then write the following:

$$\textit{Expected Outcome} = \frac{1}{3}(+1) + \frac{2}{3}(-1) = -\frac{1}{3}$$

Thus for every bet of $1 the player can expect to lose 1/3 of $1, or 33%. Therefore, the game has an expectation of −33%. Put another way, on average, for every three plays the player will lose two and win one, for a net loss of $1.

This brings us to the first major reason why casinos make money. *Almost all casino games have a negative expectation for the player.* Simply put, the rules and/or payouts are set up by the *house* so that virtually each and every bet is stacked against you. Consider the following table.

Game	Player's Expectation
Roulette	−5.3%
Craps	−2%
Blackjack	−3%
Slot Machines	−5%
Baccarat	−1.2%
Keno	−27%
State Lottery	−50%
Caribbean Stud	−9%

Each of these games will be discussed in detail later. For now, this list is meant to be a guide to an average player's expectation. Notice that the average player in each of these games has a negative expectation. Because the casino wins whatever the player loses, the house enjoys an opposite positive expectation for each of these games.

Marathons and Sprints

The mere fact that a particular game has a negative expectation does not guarantee that the player will never win. There is a second neces-

sary scientific ingredient in the casino's recipe for profitability. Even though an individual gamer like you or me may win money on any given occasion, the casino as a whole assumes almost no risk of ever having a losing day, week, or month for gaming revenues. This seeming paradox can be addressed by introducing the concept of *long and short runs.*

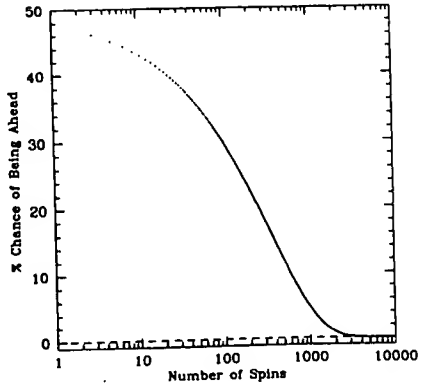
In gaming, the long run means that the number of trials approaches infinity. By trials, we can refer to spins of a Roulette wheel, hands of a Crap game or Blackjack shoe, and so on. This is fine in theory, but in practice we all have finite life spans, hence even if we could play nonstop we would never reach infinity. In the real world, we must worry about a finite number of trials and investigate what this means both for us and for the casino.

To study long and short runs, we will use one of the most beautiful casino games, Roulette. Roulette's simplicity and elegance give it an almost regal character. Suppose we're betting on the Black bet in Roulette. We'll see later that the straightforward rules allow us to determine that we have a 9/19 chance of winning 1 unit and a 10/19 chance of losing 1 unit on any given spin, for an expectation of −5.26%.[1] We wish to study what the player's negative expectation means for our winning chances.

Using arithmetic, we can calculate the theoretical distribution of possible outcomes for any number of plays. By adding up the relative probabilities of winding up with a winning session, we may predict the chance of the player being ahead. Consider the figure opposite which represents the results of such a calculation of the Black bet for odd numbers of spins. The individual points, which merge into a curve, represent the probability that the player will be ahead (that is showing a net win) as a function of the number of Black bets. For example, after 1 spin, there is a 47.4% chance of being ahead. After 11 spins (roughly a half an hour of playing time), there is a 42.9% chance that you will be ahead, while after 101 spins the probability drops to 29.8%. After 1,001 spins (about 50 hours), the chance for fame has fallen to only 4.8%. Finally, after 10,001 spins (about the number of spins you'd see in a year's worth of gambling assuming a weekend trip every weekend), the chance that you will be ahead is less than 1 in 10 million. Over time, the theoretical disadvantage will eventually and inescapably wear you (and your wallet) down.

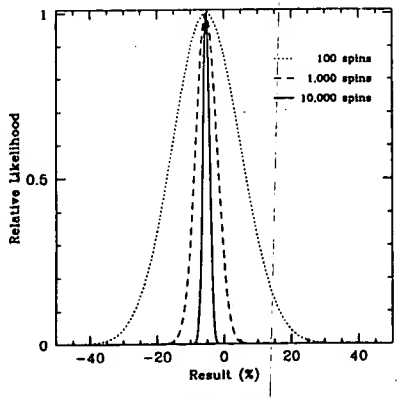
[1]Unfortunately for the casinos, the game's simplicity has also led many enterprising individuals to strive for other, nonmathematical ways to beat Roulette, and we'll also survey some of these later.

We can represent this in another way. For any arbitrary number of spins, we can convert the theoretical distribution of possible outcomes into a win/loss percentage result. For example, if we bet $1 on each of 100 spins and won 46 while losing 54, our net outcome was to lose $8. In percentage terms, our result was −8%.



Chance of winning at Roulette. Plotted is the theoretical chance of being ahead after a prescribed odd number of spins on a 1 to 1 paying Roulette wager (e.g., Black). This figure is striking testimony that over short periods of time such as hours or even days, you may be ahead, but the longer you play, the more certain your losses will become.

By cranking through some math, we wind up with the next figure which represents what I refer to as the "envelope of possibilities," or the relative chance of ending with a particular outcome. All three plots are examples of the familiar "bell curve" or normal (or Gaussian) distribution. Similar curves are known to describe anything from a distribution of students' scores on a class exam, to the average lifespan of a fly, to the background contribution in an image of a supernova remnant some 170,000 light years away.



Envelope of possibilities for Black Roulette bet. In this figure, the horizontal axis is the player's result (in percent), and the vertical axis represents the relative chance of attaining that result. The outermost (or fattest) curve represents the theoretical results from a session of 100 spins of Roulette while betting on Black. If you play 100 times, your final outcome will fall somewhere on this curve with a relative probability corresponding to the height. The next two innermost curves represent sessions of 1,000 and 10,000 spins respectively.

The chance that a player will wind up ahead can be determined by taking the area under a curve in the region of positive expectation (to the right of 0%) and dividing by the total area under the curve. As you can see, the most likely outcome (the point at which the curves peak) for all three curves is to wind up at the theoretical expectation of −5.26%. However, the area of the curve lying in positive expectation territory shrinks systematically as the number of trials increases from 100 to 1,000 to 10,000.

Furthermore, the width of each curve gets smaller as the number of trials increases from 100 to 1,000 to 10,000. It can be shown that the width of each envelope is proportional to $1/\sqrt{N}$, where N is the number of spins. And this is the crux of gaming! The longer you play, the larger the number of hands, N, becomes and the smaller $1/\sqrt{N}$ becomes. And therefore the smaller the width of the corresponding envelope becomes.

You are literally squeezed into fulfilling your ultimate destiny, which is to achieve a result arbitrarily close to the expectation of the game. *The longer you play, the more tightly the envelope of possibilities corrals you into the theoretical expectation.* Although we have created this figure assuming Roulette bets that pay 1 to 1, in fact *a similar figure can be generated for any bet with any expectation.* This is a very important concept, and one that I hope you will keep in the back of your mind.

The longer you play a negative expectation game, the more certain your losses become. It does no good to break up your play into shorter sessions or take breaks. It is true that by playing, say, 100 short sessions instead of 10 long ones, you will increase the number of winning sessions. However, you will also increase the number of losing sessions and the average percentage loss during losing sessions. And as intuitively expected, your overall performance (when all is said and done) will be *exactly* the same, regardless of how you divide up your play. The only factor that matters is the total number of trials.

But all is not lost — yet. A corollary to our discussion is that the longer you play a positive expectation game, the more certain your winnings will become! We will see later that this is important for

games, such as Blackjack, in which a skilled player can gain an advantage over the house.

The Casino Point of View

So what does this have to do with the casino as a business? Quite simply, the casino is out to make money and needs most people to lose. But each of us has heard stories from our friends, relatives, or coworkers about how they won a boatload of money on a trip to a gaming center. Indeed, if nobody ever walked away a winner, casinos would cease to exist. In the short run, the casino *needs* some of us to win.

The casinos also need people to believe that others are winning. As I overheard one young man tell his buddy in Foxwoods, "If these (slot) machines made no noise when you won, this place would be empty." The constant bells, music, and sound of coins hitting the payout bin continually reinforce the notion that you, too, can win. Why not, since everybody else is winning?

There is scarcely a casino that doesn't have a wall devoted to photographs of its "big winners." These people are usually the lucky ones who hit a big progressive jackpot on a slot machine. Their faces are now framed for all to see as we ride down escalators or wait in line at a restaurant. Being surrounded by all these winning gaming "experts" is enough to make anyone reach for some extra pocket change to give the one-armed bandits yet another pull.

When you or I walk into a casino and gamble for a few hours, we are experiencing the short run, mathematically speaking. However, management only worries about the bottom line which is the collective result of tens of thousands of patrons. So just how is the casino virtually assured of making money? Quite simply, the casino as a whole sees a sufficiently large amount of trials so that the chance of losing money is essentially 0.

Just how do the results stack up, and how many trials does this correspond to? For Roulette, we can estimate the number as follows. Let's

assume a typical roulette wheel is in operation 16 hours a day, with a new spin every 2 minutes. This corresponds to 480 spins a day, or about 15,000 spins a month. This needs to be multiplied by the number of wheels in operation at the casino, so small casinos may see 15,000 to 30,000 spins a month, while larger casinos may see 100,000 or more.

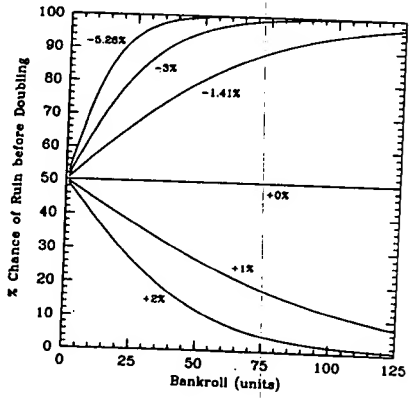
We can now calculate the casino's expectation during a typical quarter (three-month period).[2] Let us assume a total of 100,000 spins during this time. Percentage-wise, we can theoretically show that there is a 99.99% chance that the casino will make between 4% and 6.5% of the total amount wagered on its roulette wheels. Amazing, isn't it! The chance that this casino will (heaven forbid!) lose money on Roulette during this time is less than 1 in 10^{44}, that's less than one chance in a "1" followed by 64 zeros.

In essence, the keys to money-making are that the casino has a built-in positive expectation for itself and effectively sees the long run in any given period in which it is interested. Practically speaking, the thousands of patrons making millions of bets quickly collapse the envelope of possibilities for the casino so that their observed return comes very close to their theoretical expectation. Although the concepts in this chapter have been demonstrated using Roulette, I stress that a similar analysis can be conducted for *any* game. The casinos sure have it good. These faceless vaults of cash are almost assured of reaping their percentage of the total action.

Gambler's Ruin

An interesting offshoot of the above discussion is the age-old problem of gambler's ruin. Quite simply, the problem can be phrased as follows. If I win/lose 1 unit at a time, what are my chances of doubling my stake before going bankrupt? The next figure summarizes the results.

[2]Note that this estimate ignores the effect of multiple players betting on multiple bets which tends to further decrease a casino's risk.



Gambler's Ruin. The horizontal axis represents the bankroll units to be doubled, while the vertical axis represents the chance of going bankrupt before doubling. Different curves correspond to games with different expectations. This figure is a remarkable affirmation of what many of us instinctively knew all along. That is, the best chance to beat the casino (at a negative expectation game) is to just bet it all at once. Trying to overcome the casino edge with a long series of smaller bets will only lead to your demise.

There are several concepts to glean from this figure. First, for any negative expectation game, the larger your bankroll to be doubled, the smaller your chance of succeeding and the greater your chance of going bankrupt. All negative expectation games face this phenomenon. Contrarily, a positive expectation game has the opposite effect. The greater your bankroll, the greater the chance that you will double it before going bust. This leads to the following paradoxical result.

If you are attempting to double your money in a negative expectation game that pays 1 to 1, your best chance is to put the entire wad down

in a single large bet. However, if you are attempting to double your bankroll in a positive expectation game, your best chance is to make as many small bets as possible. That is, if the expectation is negative, you want to minimize the number of trials, while for a positive expectation you want to maximize the number of trials because of the "corralling effect" with the large numbers of hands.

Now the casino, for almost all games, enjoys a positive expectation. As such, although the house obviously likes to see a lot of money wagered, the "corralling effect" of the long run is critical to profitability. Flaherty of the Desert Inn in Las Vegas summarizes, "It's a fallacy to think of the total handle as the key. What's important is the total handle broken down into smaller bet sizes. The volume driving the handle is important."

By the same token, be very wary of so-called professional gamblers who claim to make their living at casino gambling. Unless they are playing a positive expectation game (such as card-counting at Blackjack), it is mathematically impossible to beat the house in the long run.

Also be wary of "systems" books that claim to beat negative expectation games such as Craps, Slots, Lotteries, and Roulette. Almost always, these systems are scientifically bogus and merely take advantage of the public's lack of awareness regarding the long-term probability of success at a negative expectation game. In the next chapter we will look at other common gambler's myths which further cost the player, thus making the casino's job even easier.

MANAGING CASINOS

A GUIDE FOR ENTREPRENEURS,

MANAGEMENT PERSONNEL

AND ASPIRING MANAGERS

RUBEN
MARTINEZ

BARRICADE BOOKS
New York

attraction there. From its inception, Puerto Rican gambling has been a model for government regulation and supervision. Many of the regulations effected in Atlantic City were inspired by Puerto Rico's strict supervision of its gambling. A trained government inspector is assigned to every casino from the beginning to the end of the operation. All gaming equipment is methodically checked by the gaming inspectors to ensure fairness to all concerned.

In 1973, the government of Puerto Rico followed the lead of the Panamanian and pre-Castro Cuban government and became a slot operator. Sixty percent of the revenues produced by the slot machines of Puerto Rico goes to the government, which in turn uses the money to support the University of Puerto Rico and other social programs. The hold percentage on these slot machines is an exorbitant 13 percent, yet the government figures that, if it has to live with a socially disruptive practice, it might as well fund social programs with it.

In 1976 by a majority vote of three-to-two, the state of New Jersey approved casino gambling in Atlantic City. Inspired in part by Puerto Rico gaming regulations that required the gambling establishment to provide a certain number of hotel rooms and facilities, New Jersey legislation required that casino operators provide at least 500 hotel rooms, 25,000 square feet of meeting hall, and a 40,000-square-foot entertainment center. The idea was to improve the Atlantic City skyline and create many jobs.

These and many other stringent regulations forced a slow growth pace in Atlantic City at first and allowed Resorts International, who had refurbished a landmark brick building, to monopolize gambling and break all kinds of income records for a time. In its first complete year of operation, Resorts International won a record-setting $220,000,000.

In its first decade, Atlantic City grew to what it is today, with the exception of the Taj Mahal. It is important to note that, in spite of having only twelve casinos, Atlantic City produces more than half as much income as all of the casinos in the whole state of Nevada.

In October of 1988, gaming reached another milestone. The Indian Gaming Act was approved, allowing Native Americans to have Class III gaming on their lands with the approval of the state government. Class III gaming includes all banking card games such a blackjack, poker, and baccarat. Although craps an roulette are not mentioned, they also fall into the Clas III category. It also includes slot machines.

This law was strongly opposed by the state o Nevada, and it is still controversial. Actually, neithe side in this disputed issue is satisfied with the law a it is written. The Indian Nations claim the right to sov ereignty over their lands, and casino operators and reg ulators fear the competition and the proliferation o organized crime on Indian lands. In the meantime gaming compacts between Indian tribes and state gov ernments continue to proliferate, and Indian gaming i expanding across the nation even faster than gamin in general. At this writing, Washington, Oregon, Cal ifornia, Nevada, Arizona, Montana, Colorado, Soutl Dakota, Minnesota, Wisconsin, Iowa, Mississippi, Nev York, Connecticut, and Florida have all approve Indian Gaming of one type or another, and many othe states are in the process of negotiating Compacts. believe that new legislatures are going to have to dea with this controversy again.

In 1989 the advent of yet another milestone in gam bling was seen. South Dakota approved what has com to be known as limited stakes casino gambling. Th main objective is to allow casino gambling revenue to stimulate the local economy without putting a unnecessary burden on the communities surroundin the casinos. It is a sort of trade-off for allowing some thing that is viewed as morally wrong. Since the lim on all wagers is only five dollars, the reasoning is tha no one will be financially ruined by frequenting thes casinos. This isn't necessarily the case.

Because of South Dakota's success, other limite stakes movements began. Iowa was the next to follo launching the first riverboat gambling operation thi century in April of 1991. In a way, this also marks milestone in gambling because of the return of rive boat gambling to this nation. At first Iowa enjoyed gre success, yet it failed to respond to the competition c other markets and evidently went through difficu times. Riverboat gambling, however, is thriving. It ha moved on to the states of Illinois, Mississippi, Missou and Louisiana, with others soon to follow.

Colorado was next to follow South Dakota's lan based limited stakes gambling lead by approving gan bling in three impoverished historic mining town

Central City, Cripple Creek, and Black Hawk. From a general point of view, gambling has been an economic success in Colorado although many growing pains have been experienced in all three towns. Fortunately, Colorado voters decided in November of 1992 that they would not allow any other city in the state to have gaming operations, at least not for another four years. That should give Colorado enough time to better understand its gambling industry.

Legislatures all across the nation are dealing with various gaming propositions and it is evident that the gaming boom is far from over. And although I have taken gaming from its Old World origins and focused on the United States, I don't want to lose sight of what is happening elsewhere. Most countries in the world either have gambling, are proposing expansions, or are proposing the establishment of gaming operations. The gaming boom is more than a national phenomenon, it is an international one as well.

THE CONCEPT OF HOUSE ADVANTAGE

Since the inception of casino gaming and even before, people have attempted to predict chance events in such a way that a profit could be derived. By doing so, certain events have become business propositions. This was one of the first ways in which unsuspecting people were taken advantage of, aside from cheating, of course. Sly bookmakers made their living this way. Aware of the true odds of chance events such as the roll of the dice, bookmakers would offer odds that were far below the true odds. However, people eventually realized they were being ripped off, and that's one of the reasons institutions such as church and government interceded to curtail the development of gambling.

By understanding that rule changes in the game affect the outcome of gaming events, bookmakers, and later casino owners, realized they could create games that were fairer to the customers and would nibble at their fortunes instead of swallowing them whole in one night. This realization allowed for the creation of craps, blackjack, baccarat, and roulette as we know them today and is credited with increasing the popularity of casino games.

These rule changes that I have mentioned affect the house advantage, which is the percentage the house has in its favor over the player. The house needs an advantage over the player because the house is offering a costly service. As in any other service business, entrepreneurs deserve to charge a commission for their services. So, not only must the house charge for the cost of the service, it must also mark it up in order to profit. Since the product or service the house provides is intangible, the house must rely on chance events and its advantage at the games to profit.

Now that you know what the house advantage is and understand the need for it, let me explain how it works. The pass line bet at the game of craps carries a house advantage of 1.4 percent, blackjack fluctuates between .5 percent to 4 percent on average depending on the skill of the player, American roulette has a house advantage of 5.26 percent, and bank bets in baccarat have a house advantage of 1.19 percent. What does it all mean? Well, for one thing it means that, if you are a perfect strategy player in blackjack and you are playing against Las Vegas Strip rules, your chances of winning are better than at the other games I mentioned. It also means that, since the house has an advantage of .5 percent, you will have to place that bet 200 times before the house can win that wager.

To players who lose their money quickly, that statement may seem unreal. But it isn't. What may seem even more unrealistic is that on a full blackjack table it would take about four hours for the house to win one bet from a player. In other words, if that player were to bet five dollars a hand on that table, the five-dollar chip would be traded back and forth until, at the end of a four-hour period, the casino would finally win it. Fortunately, not everybody plays perfect blackjack, and not everybody plays a few dollars a hand; otherwise, most casinos would go out of business.

This is one of the reasons casinos provide a variety of games and a variety of bets within those games. If craps only had pass and don't pass bets, this would be a difficult proposition for the casino, especially since the house allows crap bettors to take odds on these bets and doesn't charge them a vigorish to do so. By adding full double odds to a pass or don't pass bet, the player reduces the house's advantage to about .5 percent. And even though craps can be a faster game than blackjack, it wouldn't be fast enough to make a considerable difference. But craps has many other bets, ranging from 1.5 percent to almost 17 percent. Also, crap players are there to try to make a score and they realize the only

way to do it is to put more money into action. And that's how the house pays for its high cost of operation.

This explanation illustrates how the house advantage works in theory and not in practice. In the actual game environment, some people will lose, some will win, and some will break even. The sum of all this action over a long period of time will come close, although it will not be exactly the same as in theory. That's because, as I mentioned earlier, probability presupposes a lack of precision, and chance events are ruled by probability. What is certain, however, is that the house is going to win most of the time.

When explaining house advantage, I was dealing with actual small percentages of the main house games. This may have made the process look more complicated than it is. An illustration of a slot machine set at 10 percent might be an easier example to follow. As you can see, 10 percent fits into 100 percent ten times. Therefore, theoretically, if a customer puts ten $1 coins into a slot machine set at 10 percent, the machine would keep one and return nine. In other words, it would keep 10 percent and return 90 percent. In reality, you may find that the machine keeps all of them. That is because the reels are set for randomness, and the jackpots they pay vary from two coins for cherries up to thousands and possibly millions of dollars for progressive jackpots. The cash jackpots have been figured into the randomness equation and, therefore, most people will end up broke while others will hit the big one, or one of the big ones.

If you look at the slot win figures from Iowa, South Dakota, and Colorado, where slot machines were mostly set at 10 percent, you will see how close the win figures come to that 10 percent at the end of the month. The percentages will fluctuate between 8 and 12 percent but will mostly be close to 10 percent. By the way, competition has changed the 10 percent take.

One last thing to keep in mind when picturing the effect of the house advantage is that it is directly related to the number of decisions on each game. A decision is the resolution of the game—when the bet that was placed is either taken, paid, or left because the resolution of the game was a tie. When the dealer completes the hand and begins to take and pay on the blackjack table, that is a decision. When the dice on a crap table land on a winning or losing combination and the dealers proceed to take and pay, that is a decision.

The number of decisions per hour in every game varies. In blackjack, on average, there are about 60 decisions per hour. In craps there are about 50, in roulette about 40, and in baccarat about 60. These will vary with the number of patrons in the game, the number of bets on the game, and the speed of the dealer. These decisions are multiplied by the house advantage of the respective game to determine what percentage of the bets will be won in one hour. If you multiply 5.26 times 40, you'll find out that in one hour's time you will have won 210 percent of the player's bet in roulette. Assuming a 2 percent advantage in blackjack times 60 decisions per hour, you'll win 120 percent of the player's bet. But how can you take 210 percent of a bet? You can't. The player will have lost two bets and 10 percent of the next in that one-hour period. Remember, these are theoretical losses!

HOUSE ADVANTAGE AS THE BASIS FOR FINANCIAL SUCCESS

Obviously, it is necessary for the casino operation to have an advantage on all bets in order to realize a profit and cover operational expenses. It is also necessary for the operation to have a good mix of games and bets. Understanding this, it is easy to realize how important it is to have the "right" mix of games and bets and to have the "right" set of rules for those games and bets. If you tilt the scales heavily either way, by having a small house advantage or by having a strong one, financial ruin is certain to come. A small house advantage will not cover costs, and a strong house advantage will pummel the clientele, and they will not return nor will anyone else visit after the word gets out.

The above conceptualization of house advantage gives the impression that the solution to this equation is very simple: Keep your house advantages somewhere between small and strong, and you've got it made. In theory it is simple, but unless you understand exactly how the statistical background of the games work, you're not going to be able to do the mix appropriately nor will you know what the returns on your games and programs are supposed to be. A couple of examples may give a clearer picture of this problem.

In 1978 when Resorts International opened in Atlantic City, playing rules in the game of blackjack gave the player the advantage over the house. Of course, this privilege was only available to expert play-

ers who knew how to use the rules in their favor, and many did. These players flocked to Atlantic City, considering it the land of milk and honey. This wasn't necessarily the plan of the casino operator since it was the Casino Control Commission of New Jersey who prescribed these rules. Yet had the operators been more aware of the implications of these rules they could have made a better case to have them changed. It wasn't until the casino got swamped with card counters taking in great profits that they finally exerted enough pressure to have the rules changed.

The interesting thing here is that the casino operator should have been aware of its house advantage in the game of blackjack, but apparently it wasn't. What's even more interesting is that so-called experts, John Scarne among them, were unaware of this also. In his book *Scarne's Guide To Casino Gambling,* Scarne criticizes the Casino Control Commission for implementing what he believes to be ridiculous rules. He says that the surrender bet is unfavorable to the player, with a monstrous 22.5 percent house advantage. Contrary to what Scarne says, the early surrender bet that was implemented in Atlantic City and later eliminated carried a whopping .624 percent advantage for the player. And although it may seem exaggerated to say whopping to less than 1 percent, it isn't if compared to other blackjack rules such as doubling down on three cards or more (.20 percent), drawing on split aces (.14 percent), and doubling down on split pairs (.13 percent). Most of all, it isn't exaggerated when compared to the house advantage on a six-deck shoe with strip rules that carry a house advantage of from .55 percent to .60 percent, depending on whether or not the casino allows the player to double down on split pairs. It certainly wasn't exaggerated in Atlantic City where the rule gave the player a .20 percent advantage on a four-deck shoe and a .11 percent advantage on a six-deck shoe.

Casinos aren't in the nonprofit category of business and will not survive without strict attention to the house-advantage concept. However, it is easy to criticize from a distance and make cold decisions based on facts and figures, but not as easy to react effectively when the competition uses rule changes and other gimmicks to attract customers. That is why a clear understanding of the concept of house advantage is so important to the casino's financial success. When responding to changes in the gaming environment such as competition, we must be able to make educated and calculated decisions, and be well aware of the costs and consequences of every action.

THE OLD SCHOOL OF GAMING

In gaming, as in many other businesses, some people believe old ways are the best ways. The people who cling to these old precepts in gaming are said to have an *old-school mentality* or to be coming from the old school. Unfortunately, many of the people who think this way have worked themselves into different management levels. Their antiquated ideas have miraculously survived and have become the subject of written and unwritten gaming procedures. Here are just a few examples of these old-school beliefs. Fortunately, they're not being practiced everywhere.

Women don't belong in the gaming business. This concept probably stemmed from the banning of women in early casinos. Gaming was viewed as masculine entertainment; therefore, women were not allowed to gamble or even be employed by a casino. This thinking has gradually disappeared, mainly because women's groups have fought hard for equality in the workplace. However, up until a quarter of a century ago, women were not allowed to be dealers or supervisors in a casino. Today, most managements have learned that female employees can be just as efficient as male employees. However, some from the old school still dispute the fact that women can perform as competently as male managerial employees. There's no justification for people who base hiring, game assignments, and promotion decisions on irrational and biased ideas such as those that suggest gender inferiority.

Women don't belong in the crap pit. Of all casino games, craps was the last one to welcome women players and employees. Traditionally, it has been regarded as the hardest of all games to learn and has mainly attracted aggressive male players who frequently use foul language when excited. Because of this view of the game, many thought it wasn't the best place for a woman. This view of women presumed that they were not as smart as men and couldn't handle themselves in an abusive situation. Time has proven otherwise. Today in the crap pit women are both players and very efficient employees. They not only deal the game as well as men; they have also handled abusive patrons

CASINO OPERATIONS MANAGEMENT

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New York • Chichester • Weinheim • Brisbane • Singapore • Toronto

Chapter
7

Slot Management

SLOTS

In the year ended December 31, 1996, the nineteen largest casinos ($72 million and over in yearly casino win) on the Las Vegas Strip reported total gaming win of $3.09 billion. Win from slot machines accounted for $1.44 billion or 47% of the total gaming win. The departmental profit margins for the slot area are just as impressive, with slots contributing as much as 75% of the total casino profit. Slot machines are becoming crucial to the success of today's casinos.

Slot machines come in a variety of models. Examples of different types of models include: Sizzling 7s; Red, White, & Blue; Jackpot Jungle; and Slam Dunk. Each individual slot machine is referred to as a game.

Types of Slots There are three major categories of slot machines:

- Line Games
- Multipliers
- Buy-A-Pays

Line games allow the player to "activate" additional lines with each coin inserted. The player will see three symbols "in the glass" for each reel. A three-reel slot would look as follows:

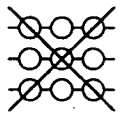
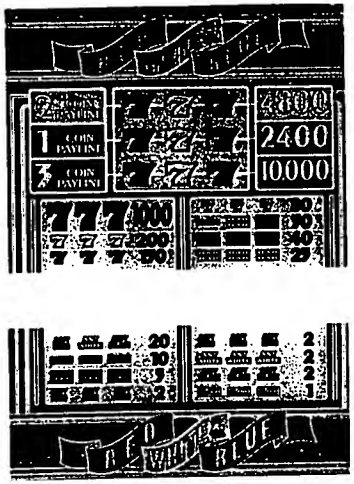


Figure 7.1 shows an example line game. As many as five different pay lines can be activated.



RED, WHITE, AND BLUE
3R-3 Line
(104D)

Figure 7.1 Line Game (Courtesy of IGT)

Multipliers are games that pay on the center horizontal line only. As additional coins are inserted, multipliers "multiply" the payout per coin. For example, one cherry on the pay line might pay two coins with one coin inserted and ten coins with five coins inserted. See Fig. 7.2 for an example.

Buy-a-pay games pay on the center horizontal line only, but the player is allowed to "buy" additional jackpot symbols. For example, the only symbols that pay with one coin inserted might be the single bars, double bars, triple bars and any bars. Whereas with a second coin inserted, Red 7s and Sizzling 7s will pay in addition to the bars that were bought with the first coin. On a buy-a-pay, the player would receive nothing if the three Sizzling 7s were lined up on the center pay line with only

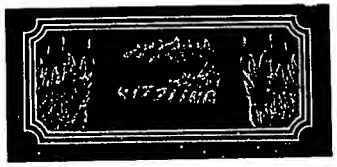
SLAM DUNK
2 Coin Multiplier
(140A)

Figure 7.2 Multiplier Game (Courtesy of IGT)

one coin inserted. Figure 7.3 provides an example of the award glass for buy-a-pay games.

Slot Terms There are a myriad of terms that apply to the operation and management of a slot department. The following list discusses several of the most common terms encountered in the day-to-day operation of a slot department.

1. *Coin-in.* Unlike the table games where the only information known to the casino is how much the player bought in at the table, slot machines include meters that indicate the total amount



Sizzling 7s
2-Coin, Buy-A-Pay
(107B)

IGT

Figure 7.3 Buy-A-Pay Game (Courtesy of IGT)

inserted into the machine. As each coin is inserted, the coin-in meter advances and maintains a cumulative total for all coins inserted into the machine. This coin-in feature allows management to monitor exactly what percentage the machine is winning and then compare that percentage to the games theoretical win percentage. The coin-in feature also allows management to monitor the volume of play for a machine in order to evaluate the popularity of the machine with slot players.

2. *Hopper.* Each slot machine has an internal coin bank called a hopper. All machine pays are made through this hopper, which works much like the tank on a water closet or toilet. When the tank gets full, a float stops the water flow. Management determines the amount the hopper will hold and, once the predetermined amount is reached, any additional coin-in is diverted to the drop bucket located in the slot stand directly below the slot machine. Figure 7.4 shows an example of a typical slot machine.
3. *Drop.* Any coins inserted into the slot machine when the hopper is full are diverted to a bucket below the slot machine. The total amount of coin in this bucket is called the drop.
4. *Casino Advantage (par).* The percentage of each dollar wagered that the house wins is called the casino advantage. The casino advantage is a theoretical amount, but the actual percentage will approximate the theoretical advantage after a large number of games are played. The number of games that must be played for

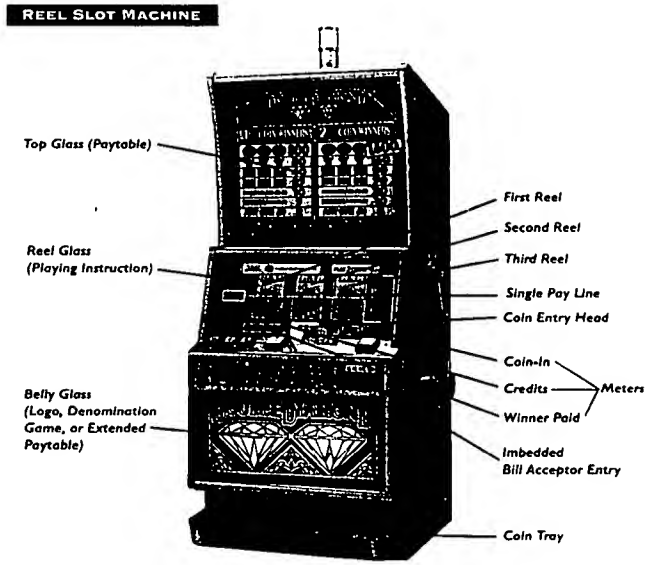


Figure 7.4 International Game Technology (IGT) Slot Diagram

the actual percentage to approximate the theoretical varies based on the slot machine type.

5. *Hold (actual).* Since slot machines have the capability of providing total coin-in, management is able to calculate the percentage of the total wagered that is actually won by the slot. This calculation is called the hold.
6. *Progressive.* Progressive slot machines are the most popular slots around. Progressive slots allow for what is called a "deferred" payout. For example, the progressive meter might advance four cents for every dollar inserted into the machine. This four-cent advancement represents four cents the "public" has just won. The increments accumulated in the progressive amount displayed by the machine(s) will be held by the casino until some lucky player lines up the jackpot symbols which result in the progressive amount being paid.

   MegaBucks, Nevada Nickels and Quartermania are examples of progressive slot machines. Each casino will also have progressives of their own, and progressives of this type can be found in casinos around the world.
7. *Linked Progressive.* Linked slot machines all share the same progressive meter. As a coin is inserted into a single machine, the progressive meter on all of the machines increases. The largest linked progressive jackpot ever paid was on International Game Technology's (IGT's) MegaBucks. MegaBucks includes almost 1,000 machines located in various parts of Nevada that are all linked through a central computer system located in Reno. This type of linked progressive was developed as Nevada's answer to the California lottery since Nevada does not have a state lottery. Linked progressives of the type represented by MegaBucks have now become common to many other gaming jurisdictions in the United States where slot machines are permitted.
8. *Progressive Accrual.* Until the progressive jackpot is won, the amount on the progressive meter is held in escrow by the casino for the player who wins the progressive jackpot. Any amount reflected on the progressive meter is recorded by the casino as a liability. Since progressive jackpots may vary substantially in the dollar amount and frequency of payout, casinos may establish a threshold below which they will not record the progressive amounts as a liability for financial accounting purposes.
9. *Machine Fill.* Like table games, slot machines will run out of money at times. When the hopper goes empty, it must be replenished. This replenishment is know as a fill.
10. *Handpay.* On large jackpots, the hopper in the slot machine does not contain enough coins to make the payout. As a result, slot machines are designed to require management participation to complete the payout on large jackpots. These payouts are known as handpays. For example, a player would receive the payout in the form of a handpay if she were to hit MegaBucks for $3.8 million.
11. *Hit Frequency.* The percentage of pulls that the machine pays at least one coin is known as the hit frequency and is expressed as a percentage. A machine with a 20% hit frequency will pay something 20 times out of 100 times the handle is pulled.

Slot Mix is the term that describes the quantity, type, denomination and strategic placement of machines that management has chosen to offer the public. The variables that comprise the slot mix are:

- Model mix
- Mechanical configuration
- Floor configuration

Model Mix

Slot machines come in line games, multipliers, and buy-a-pays. They are available in either video or mechanical. Although video poker is not called a slot (it is actually called video poker), it does qualify as a model option. In addition, there are numerous specialty games, including blackjack, keno, bingo, dice, horse racing, and dog racing. Almost every game is available as a stand-alone or linked progressive.

Each reel game is available as an upright game or slant top. Video pokers are available as uprights, slant tops or bar tops. Table 7.1 shows a breakdown of the slot machine population in Nevada.

Slot machine popularity differs from casino to casino and target market to target market. For example, the casinos in Las Vegas that cater to local customers offer predominantly video poker machines, whereas the Strip casinos catering to tourists have primarily reel type slots. One reason for the difference in preference seems to be the level of sophistication of the gambler. Local customers seem to be more astute gamblers who know that video poker machines may have a lower casino advantage. In addition, video poker machines involve a thought process where the player must make certain decisions. With reel slot machines, the only decisions the player makes is which machine to play and how many coins to bet.

Mechanical Configuration

Elements of mechanical configuration include coin denomination, payoff schedule/reel strip combination, casino advantage and hit frequency. The slot manager must decide the number of machines of each denomination to offer and where the different denominations should be placed. When planning to open a casino, in order to determine the initial slot mix, management would first identify the customer base to be targeted and then

Table 7.1 1997 Nevada Gaming Census

41.0%	upright reel slot
19.1%	upright video poker
4.9%	bar top poker
11.7%	slant top poker
15.0%	slant top reel slot
3.1%	keno
3.9%	multigame
169,964	total machines
1.2%	other
	By manufacturer
78.89%	IGT
11.29%	Bally
4.34%	Sigma
1.90%	Universal
.84%	Anchor
.76%	P&M
.76%	CDS
.26%	CEI
.96%	Other

Source: IGT survey, nonrestricted casinos only.

prepare an analysis of what competitors have chosen to offer their customers. If certain competitors were identified as being successful in reaching the customer base targeted, management may consider duplicating the competitor's mix initially. Once the casino is open, the slot data would be analyzed and used to modify the mix of machines.

What mix should be used for a new gaming market? New gaming markets present a special challenge for the casino operator since historical information does not exist relevant to customers and competitor performance in the market. In IGT's manual "Getting Started in Gaming," a recommended mix for a new gaming market is suggested, as shown in Table 7.2.

In practice, where the market is developed, the games and denominations offered will vary significantly. Within a given market, the mix will vary from target market to target market. For example, the primary customer target market of the Mirage and Caesars Palace is the tourist, while Sam's Town and Palace Station target the local gambler. A comparison of games selections for these four casinos illustrates how customer game preferences differ (as of August 1995):

Table 7.2 Example Slot Mix for a New Gaming Market

	Reel vs Video Poker		
	• Spinning Reel Slots	80%	
	• Video Poker	20%	
	By Denomination		
	5¢	11%	
	25¢	68%	
	$1 and above	21%	
	Reel Slot Game Selection by Denomination		
	5¢	25¢	$1
2-coin multiplier	0%	40%	50%
3-coin line	40%	20%	10%
3-coin multiplier	25%	25%	35%
3-coin buy-a-pay	10%	10%	5%
5-coin line	10%	2%	0%
5-coin multiplier	15%	3%	0%
	Video Poker Game Selection by Denomination		
	5¢	25¢	$1
5-coin multiplier	80%	100%	100%
10-coin multiplier	20%		

	Sam's Town	Palace Station	Mirage	Caesars Palace
Total	2,860	2,115	2,194	1,956
Video Poker	62%	54%	23%	23%
Reels	32%	33%	76%	76%
Video Keno	6%	13%	1%	1%

Why the difference? As mentioned previously, local customers generally are more sophisticated players and video poker machines tend to be attractive to a higher level of gambling sophistication. Video poker machines provide a lower casino advantage, a hit frequency of about 50% and require the player's interaction.

Locals do not start out as more sophisticated players. Their more frequent play leads to increased knowledge. When Colorado gaming was first introduced, the target market was primarily local customers (locals) from the Denver area, and Las Vegas experience had shown that locals prefer video poker. However, the Denver locals were not as familiar with gaming or as sophisticated as the Las Vegas locals. Consequently, a mix

with a high percentage of video poker machines was not successful in this market, as the locals showed a preference for reel type slots. Over time, video poker machines will likely represent an increasing percentage of the total machine population.

Payoff Schedule/Reel Strip Combinations There are two primary types of reel strips: ghost strips and fruit strips. The names are somewhat misleading in that ghost strips can contain fruit symbols. Fruit strips contain a symbol for every possible stop on the reel. For example, a 20-stop fruit strip would contain 20 symbols.

On the other hand, ghost strips have fewer symbols than stops. A 20-stop ghost strip can have 11 symbols and nine ghosts; ghosts allow the reel to stop between symbols. Ghost strips are by far the most popular in today's market. Over 95% of the total slot machines sold in the United States contain ghost strips. When the Gold Coast opened in Las Vegas, the casino included 900 machines. Six hundred of these machines were video poker and 300 were slot machines. Of the 300 slots, only six were fruit strip type machines.

Casino Advantage Casino management must select games at house advantages that result in the most profit. Slot machine advantages range from as low as 0.5% to as much as 30%. However, higher house advantages do not necessarily result in the highest win. Many casino operators advertise low-advantage machines in the belief that the decrease in house advantage will be more than offset by the increase in volume.

Many gaming jurisdictions have established minimum levels at which slot machines must pay back in order to prevent casino operators from placing players at too great a disadvantage. Atlantic City gaming regulations require that slot machines must pay back at least 83%, which means a 17% advantage for the casino. Nevada Gaming Regulation 14.04 states that machines must theoretically pay out a mathematically demonstrable percentage, per coin wagered, of at least 75%.

Hit Frequency The percentage of time the machine pays something to the player. Conventional management philosophy is that high hit frequency machines stimulate play. When purchasing slot machines, management must first choose the particular model, then the desired casino advantage and finally the hit frequency. Hit frequencies range anywhere from single digit to the high 30% range for multipliers and buy-a-pays. Hit frequencies for line games can exceed 100%.

Physical/Expanded Reel The reels on today's slot machines appear to stop mechanically much like their predecessors. In actuality, the reels stop and display the symbol according to what was chosen by the slot machine's internal computer chip, which is known as an EPROM (erasable, programable read-only memory). As a result of this advancement in technology, it is no longer necessary to physically place the same number of symbols on the reels as is possible on the "computer reel."

When computerized slot machines were first introduced, they were equipped with a video terminal which displayed a picture that was designed to give the appearance of slot machine reels. However, the playing public realized that the video reels could have hundreds or even thousands of symbols since they could not see the actual size of the reels. As a result, customers believed that they had little chance of hitting the jackpot. Later, the slot machine manufacturers found they could incorporate the same technology in machines with actual spinning reels.

Today's machines have physical spinning reels, but the symbol where the reel stops is determined by computer. This new type of electronic machine with spinning reels is called a "stepper slot." There is little relation between the physical reel and the possibilities available to the computer. It is only necessary to put one of each symbol on the physical reel, but the playing public would probably become suspicious.

The slot machines being supplied today offer the best of both worlds: (1) players feel that they have a good chance of hitting the jackpot and (2) the slot machine can have an infinite number of reel strip/payout combinations that provide large jackpots. If not for this technology, million-dollar slot jackpots would not be possible.

PC Sheet (game sheet, specification sheet, theoretical hold worksheet) PC sheets are prepared by the manufacturer and are supplied to the casino operator at the time the slot machines are purchased. Gaming regulations in Nevada and many other gaming jurisdictions require that a PC sheet be maintained for every slot machine or type of slot machine. The PC sheet lists the machine's model number, paytable number, each pay combination and hit frequency, reel strip listing and theoretical hold percentage (i.e., casino advantage).

The reel strip listing includes both the physical listing that the player would see if the strip were taken off the reel and the expanded listing that details what symbols are available for random selection by the machine's computer. Figure 7.5 depicts an example of an IGT three-reel, two-coin multiplier's PC sheet and reel strip listing

VIDEO POKERS

Table 7.3 lists the probabilities for video poker. The first game's lowest pay is a pair of Jacks or better, the Full House pays seven coins and the Flush pays 5 coins. The "total" column assumes the best play possible and was provided by International Game Technology (IGT). The correct way to play the hands is determined by the pay table. As the pay table

RS: 1722 3R2CM MU PRC: 85.495 HTFQ: 14.212 P:H 08:21:07 27-FEB-87

IGT

International Game Technology

520 South Rock Blvd.

Reno, Nevada 89502

Reel Strip Number 1722 HOLD % 14.505
MODEL # : ##36X PAYTABLE 34A211
90% Confidence Value, 10,000,000 pulls Low %: 85.18% High %: 85.81%

Coin	Percent Pay Back	Hit Freq	Total Hits	Total Pays
1	76.080%	14.212%	4657	24930
2	85.495%	14.212%	4657	56030

NUMBER / REEL

SYM	R1	R2	R3
—	17	19	21
1B	9	7	8
5B	4	4	3
7B	1	1	1
JW	1	1	1

This is a 3 reel, 2 Coin 32 stop machine, Reel Combos: 32768

PAY COMBO	# PER REEL	HITS	PULLS/HIT	PAYS	TOTAL PAY
JW XX XX	1 31 31	841	39	2	1682
XX JW XX	31 1 31	821	40	2	1642
XX XX JW	31 31 1	793	41	2	1586
JW JW XX	1 1 31	21	1560	5	105
JW XX JW	1 31 1	19	1725	5	95
XX JW JW	31 1 1	17	1928	5	85
AB AB AB	15 13 11	1479	22	5	7395
1J 1J 1J	10 8 7	559	59	10	5590
			Coin # 2	25	
5J 5J 5J	5 5 4	99	331	50	4950
			Coin # 2	125	
7J 7J 7J	2 2 2	7	4681	200	1400
			Coin # 2	500P	
JW JW JW	1 1 1	1	32768	400	400
			Coin # 2	1000P	
	Total hits	**4657**	**Total Coins Paid**		**24930**

Figure 7.5 (a) IGT 3-reel, 2-coin Multiplier's PC Sheet and Reel Strip Listing (Courtesy of IGT)

Reel Strip Listing

Physical Reel Strip Listing

Line #	1	—	—	—
Line #	2	1B	1B	1B
Line #	3	—	—	—
Line #	4	5B	5B	5B
Line #	5	—	—	—
Line #	6	1B	1B	1B
Line #	7	—	—	—
Line #	8	7B	7B	7B
Line #	9	—	—	—
Line #	10	1B	1B	1B
Line #	11	—	—	—
Line #	12	5B	5B	5B
Line #	13	—	—	—
Line #	14	1B	1B	1B
Line #	15	—	—	—
Line #	16	5B	1B	1B
Line #	17	—	—	—
Line #	18	JW	5B	5B
Line #	19	—	—	—
Line #	20	1B	1B	1B
Line #	21	—	—	—
Line #	22	5B	JW	JW

Expanded Reel Strip Listing

Line #	1	—	—	—
Line #	2	—	—	—
Line #	3	1B	1B	1B
Line #	4	1B	—	—
Line #	5	—	—	—
Line #	6	5B	5B	5B
Line #	7	—	5B	—
Line #	8	1B	—	—
Line #	9	—	—	1B
Line #	10	—	1B	—
Line #	11	7B	—	—
Line #	12	—	—	7B
Line #	13	—	7B	—
Line #	14	1B	—	—
Line #	15	1B	—	1B
Line #	16	—	1B	—
Line #	17	—	—	—
Line #	18	5B	5B	5B
Line #	19	—	—	—
Line #	20	1B	—	—
Line #	21	1B	1B	1B
Line #	22	—	1B	—
Line #	23	5B	—	1B
Line #	24	—	1B	—
Line #	25	—	—	—
Line #	26	JW	—	5B
Line #	27	—	5B	—
Line #	28	—	—	—
Line #	29	1B	1B	1B
Line #	30	1B	—	—
Line #	31	—	—	—
Line #	32	5B	JW	JW

90% CONFIDENCE VALUES VOLATILITY INDEX = 9.926 (at max coin)

HANDLE PULLS	LOWER PERCENTAGE	UPPER PERCENTAGE
1,000	54.11	116.88
10,000	75.57	95.42
100,000	82.36	88.63
1,000,000	84.50	86.49
10,000,000	85.18	85.81

Special Symbols
AB: 1B, 5B, 7B, JW **1J:** 1B, JW **5J:** 5B, JW **7J:** 7B, JW

Figure 7.5 (b) IGT 3-reel, 2-coin Multiplier's PC Sheet and Reel Strip Listing (Courtesy of IGT)

Table 7.3 Video Poker Game Sheet and Optimum Play Results (per IGT estimate)

7/5 schedule

		ONE COIN				5th COIN BONUS	
	DEALT	*BUILT*	*TOTAL*	*PAYS*	*COIN-OUT*	*PAYS*	*COIN-OUT*
ROYAL FLUSH	4	60,714	64,714	250	16,178,5250	4000	258,856,4000
STRAIGHT FLUSH	36	244,1679	280,1679	50	14,008,3950	250	70,041,9750
FOUR-OF-A-KIND	624	5,515,0034	6,139,0034	25	153,475,0850	125	767,375,4250
FULL HOUSE	3,744	26,172,3687	29,916,3687	7	209,414,5809	35	1,047,072,9045
FLUSH	5,108	23,230,2802	28,338,2802	5	141,691,4010	25	708,457,0050
STRAIGHT	10,200	19,120,9469	29,320,9469	4	117,283,7876	20	586,418,9380
THREE-OF-A-KIND	54,912	138,532,4912	193,444,4912	3	580,333,4736	15	2,901,667,3680
TWO PAIR	123,552	211,745,0154	335,297,0154	2	670,594,0308	10	3,352,970,1540
JACKS OR BETTER	337,920	221,091,8658	559,011,8658	1	559,011,8658	5	2,795,059,3290
TEN'S OR BETTER	422,400						
Less than pair 10's	1,640,460						
TOTALS	2,598,960				2,461,991,1447		12,482,919,4985
					COIN-IN		12,994,800,0000
					COIN-OUT		2,461,991,1447
					WIN		136,968,8553
					%ADV.		5.27%
					%RETURN		94.73%

10's or Better

	DEALT	*PAYS*	*BUILT*	*TOTAL*	*PAYS*	*BUILT*	*TOTAL*	*PAYS*	*BUILT*	*TOTAL*
ROYAL FLUSH	4	300	70,8500	74,8500	250	60,4542	64,4542	250	60,7141	64,7141
STRAIGHT FLUSH	36	50	259,7616	295,7616	50	248,0663	284,0663	50	243,9080	279,9080
FOUR-OF-A-KIND	624	25	5,442,7523	6,066,7523	25	5,516,0430	6,140,0430	25	5,517,0826	6,141,0826
FULL HOUSE	3,744	9	25,894,2799	29,638,2799	9	26,175,7473	29,919,7473	8	26,179,6458	29,923,6458
FLUSH	5,108	6	23,559,0486	28,667,0486	6	23,518,2449	28,626,2449	5	23,224,8223	28,332,8223
STRAIGHT	10,200	4	18,984,7614	29,184,7614	4	18,999,5755	29,199,5755			
THREE-OF-A-KIND	54,912	3	135,487,5497	190,399,5497	3	138,577,1934	193,489,1934	3	138,613,5788	193,525,5788
TWO PAIR	123,552	1	208,022,2772	331,574,2772	2	212,438,6899	335,990,6899	2	212,489,3697	336,041,3697
JACKS OR BETTER	337,920				1	219,777,8316	557,697,8316	1	221,039,8866	558,959,8866
TEN'S OR BETTER	422,400	1	232,260,3511	654,660,3511						

Source: Courtesy IGT

changes, the way the hands are played must change in order for play to be optimized. Compare the best play results of the two tables.

On the 7/5 pay schedule, the optimum player return is 96.1% at maximum coins-in and 94.73% at one coin-in. Naturally, every player will not play maximum coins or play the game perfectly. Consequently, IGT estimates that the hold the casino should expect is between 2%-4% more than optimum play. On the 7/5 schedule, the optimum return is 96.1%, but the actual expected casino payback to the player should be between 92.1% and 94.1%.

The slot manager has several different types of video pokers from which to choose. The types of slot machines available consist of line games, multipliers or buy-a-pays. Video poker choices are

- Jacks or Better
- Tens or Better
- Deuces Wild
- Joker Poker (one joker serves as a wild card)
- Deuces-Joker Wild

Each type of video poker comes in a variety of pay tables that offer a choice of casino advantages. Figure 7.6 provides an example of a typical video poker machine.

Slot Volatility

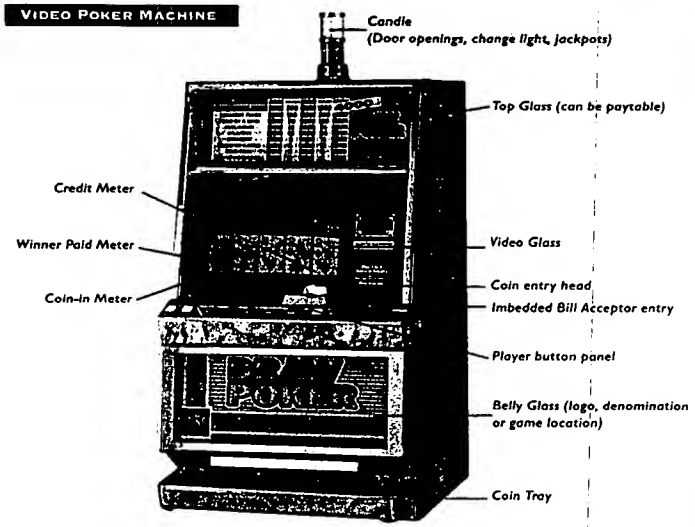
Slot Machine Volatility Although each machine has a fixed casino advantage, the actual hold can vary drastically from the theoretical advantage. The PC sheet for the reel-type machine included previously in this chapter has a return, at maximum coins bet, of 85.495%. However, the casino can expect to be returning between 54.11% and 116.88%[1] (holding between 45.89% and -16.88%) at 1,000 games played. As the number of games played increases, the actual hold will more closely approximate the machine's theoretical hold. At 10 million games played, the same machine will return between 85.18% and 85.81% (holding between 14.19% and 14.82%).

The amount the actual hold varies from the theoretical hold is a function of the machine's volatility index. Each machine has its own volatility index which is influenced by the total number of pays, the size of the pays and the machine's theoretical payback. Management must be familiar with the concept of slot volatility and must know exactly how unusual the results they are experiencing are prior to determining whether something is wrong with a particular machine's hold.

In practice, casino management should investigate a machine if the actual hold of the machine is outside a range of acceptability as deter-

[1] With a 90% level of confidence.

VIDEO POKER MACHINE



Video Poker Machine: Video machines have no reels, but display an electronic representation of playing cards on a video screen. The machines are played in the same manner as the reel slot; after a player activates the machine, an award is partly based on the resulting combination of playing cards.

SAMPLE TOP GLASS FOR VIDEO POKER
Jacks Or Better 1-5 Coin

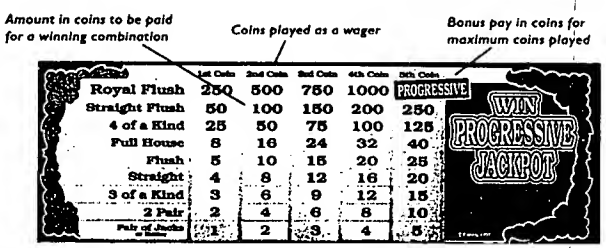


Figure 7.6 IGT Video Poker (Courtesy of IGT)

mined by the number of games played and the machine's volatility index.

Calculating Slot Volatility The formula for the volatility index (V.I.) is

$$V.I. = k\sigma$$

where k equals the z score for the required confidence limit and σ equals the standard deviation for the game.

The game's standard deviation is calculated as follows:

$$\sigma = \sqrt{\sum_{i=0}^{N}[(\text{Net Pay}_i - \text{E.V.})^2 \times \text{probability}_i]}$$

Net Pay_i = the amount of each individual pay divided by the number of coins wagered *minus* 1, e.g., a 25-coin pay with 2 coins wagered equals 12.5 *minus* 1 *equals* 11.5

E.V. = player's theoretical disadvantage for "x" coins wagered, i.e., the above machine, the player's disadvantage with one coin wagered is 23.92% and 14.505% with two coins wagered.

probability = probability of each Net Pay

With one coin played, the machine has pays of minus 1 (when the player loses); two for 1; five for 1; ten for 1; fifty for 1; two hundred for 1; and four hundred for 1. There are a total of 28,111 minus one hits; 2,455 *two* for 1 hits (841 + 821 + 793); 1,536 *five* for 1 hits; 559 *ten* for 1 hits; 99 *fifty* for 1 hits; 7 *two hundred* for 1 hits; and, 1 *four hundred* for 1 hits. The respective casino Net Pays (fig. 7.5) are: –1; –4; –9; –49; –199; –399; and 1.

A	B	C	D	E	F	G
Net Pay	*# of Hits*	*Probability*[2]	*Expected Value*[3]	*A–D*	*E*[2]	*C×F*
1	28,111	0.85787964	0.2392	0.76080	0.578	0.496559
-1	2,455	0.0792065	0.2392	-1.23919	1.535	0.115049
-4	1,536	0.04687500	0.2392	-4.23919	17.970	0.842381
-9	559	0.1705933	0.2392	-9.23919	85.362	1.456231
-49	99	0.00302124	0.2392	-49.23919	2424.498	7.324992
-199	7	0.00021362	0.2392	-199.23917	39696.257	8.480035
-399	1	0.00003052	0.2392	-399.23917	159391.936	4.864256
Total Hits = 32,768						Variance = 23.579504

[2] Probability is obtained by dividing # of hits by total hits.

[3] Expected Value equals the machine's theoretical win.

$$\sigma = \sqrt{\sum_{i=0}^{N}[(\text{Net Pay}_i - \text{E.V.})^2 \times \text{probability}_i]} = \sqrt{23.579504} = 4.8559$$

At a 90% confidence interval, the Volatility Index (with one coin-in) would equal

$$\text{V.I.} = k\sigma = 1.65 \times 4.8559 = 8.01219$$

The 1.65 corresponds to the z score that comprises 90% of the area under the normal curve. A 95% confidence interval would require a z score of 1.96.

A volatility index of 9.926 is listed for the machine. Using the above model, the same number should be derived.

To determine the upper and lower limits for a given number of games played, use the following formula:

$$\text{Percent Payback} \pm \frac{V.I.}{\sqrt{\text{games played}}}$$

With two coins wagered, the machine has an 85.495% payback and a volatility index of 9.926. At 1,000 games played and a 90% level of confidence, the expected payback should fall within the following range:

$$85.495\% \pm \frac{9.926}{\sqrt{1{,}000}} = 85.495\% \pm 31.389\% = 54.11\% \textit{ to } 116.88\%$$

FLOOR CONFIGURATION

Once the slot manager has determined the machines needed, the next task is to decide where the machines should be placed on the casino floor. The placement of the machines is known as the floor configuration. Floor configuration considers both general placement and specific placement.

General placement deals with where the slot banks, coin booths and slot carousels will be placed. Slot banks refer to groupings of slot machines, while coin booths and slot carousels are areas on the casino floor where players can purchase coins and tokens for use in the slot machines.

In considering general placement, each slot cabinet that will hold a slot machine must be viewed as an empty box. These "empty boxes" can be used to create traffic patterns or conversely to impede traffic patterns. The overriding consideration is to place the machines where the maximum number will be viewed by slot players. Enticements such as the showroom, bingo parlor, keno parlor, casino bars, race and sports book and restaurants create traffic. These enticements (sometimes called anchors) influence slot placement. For example, slot machines should be placed at the entrance and exit of the bingo parlor or showroom in such a manner that customers exiting will be exposed to the maximum number of machines.

Aisle Width Generally, slot aisles are between 5½ and 7 feet in width. Aisles which are too narrow cramp the customer and may have a negative impact on profit maximization. The extent of seating the slot manager decides to make available will determine the aisle width necessary. An additional consideration is that wider aisles provide less room for machines since the area dedicated to slot machines within the casino floor is fixed.

From 1931 to the late 1970s, casino operators paid little attention to the slot player's desire to sit while playing. Today, the availability of seating is crucial to the success of a slot operation. In Atlantic City, regulations require all aisles to be at least 7 feet wide and only fixed seating can be provided. This fixed seating rule results from concerns that movable seats could impair the customer from exiting in the event of a fire. The fire marshals in this jurisdiction believe that the movable seats could topple over and trip exiting guests.

In Nevada, use of fixed or movable seating is left to the discretion of management. Movable seating provides the slot manager more flexibility and requires less aisle width, thereby increasing the room for slot machines on the casino floor. Movable seating also allows a player to stand if desired.

Specific placement deals with placement of the specific models and coin denominations. There are several general philosophies that influence specific slot placement:

1. Low hold (loose) machines should be placed in busy walkways to create an atmosphere of activity.
2. Loose machines are normally placed at the beginning and end of traffic patterns.
3. The most popular machines should be placed near entrances where they can easily be seen by someone trying to decide whether or not to enter the casino.
4. High hit frequency machines located around the casino pit area will create an atmosphere of slot activity.
5. Some slot managers believe that "garbage" machines should be placed in areas which are less attractive to players, such as the entrance to the restrooms. Garbage machines refer to machines which are popular with the slot player but which provide a low return to the casino.
6. Machines should be placed near compatible enticements. For example, keno machines should be placed next to keno, poker machines next to poker, etc.

7. High earners and test machines should be placed in heavy traffic areas.
8. Gimmick machines (machines where the top award is a prize like a new car or a trip around the world) should be placed near entrances and in high traffic areas.
9. Dollar machines and above should be placed around the pit area and nickel machines placed at the perimeter (placement by denomination).

The above represent only general philosophies governing slot placement. In application, the slot manager will continue to modify the slot floor configuration to best attract and retain customers through the use of available slot performance data.

DETERMINING SLOT WIN

To determine how much a given slot machine has won, the following information is needed:

- the slot drop
- the total amount in jackpots
- the total amount in slot fills made
- for progressive slots, the amount of the progressive accrual

With the above information, the formula for slot win is:

Slot Win = Drop – Jackpots – Fills – Progressive Accrual

In addition, the actual hold of the machine can be compared with the theoretical hold by dividing the slot win by the coin-in. Since the casino has use of the amount of the progressive until the jackpot is hit, Nevada's regulations require that gaming taxes be paid pursuant to the following calculations:

Slot Win for Tax Purposes = Drop – Jackpots – Fills

With the use of this method, taxes are paid once the casino has access to the funds. The progressive becomes a jackpot at the time it is hit and, as a result, is deducted from slot win.

THE IMPORTANCE OF HIT FREQUENCY

The manufacturer often provides a catalog of the various machines they produce in order to assist in the selection of machines. This catalog includes graphics of the machine's top and belly glasses. Each machine

available has a distinct payback and hit frequency. Typically each model of machine, Jackpot Jungle for example, comes in a variety of paybacks and hit frequencies. The payback and hit frequency of a machine is depicted in the PC sheet included earlier in this chapter. Table 7.4 shows the different paybacks and hit frequencies available for IGT's 2-coin multiplier "Fist Full of Dollars".

Strip 3375 is available with a 95.058% maximum coin payback. The 1st coin payback is 94.372%. The machine's hit frequency is 12.777% and it is a 3-reel machine with 64 stops on each reel. The top award at maximum coins-in is $5,000 and the corresponding award is $2,000 at one coin-in. There is only one combination that yields the top award payout. The second highest award at maximum coins-in is $500 and is $200 at one coin-in. If all possible combinations that earn a pay were listed, there would be 26 combinations.

As indicated by Table 7.4, the same model is available in paybacks as low as 91.058% and hit frequencies from 12.337%. Many models are available in over a dozen different payback and hit frequency combinations. All of the machines of a particular model have the same external appearance. From the customer's perspective, the machines all appear to be the same because the player has no way of knowing the machine's particular configuration. The availability of different paybacks for the same model permits management to provide a mix that will yield the highest casino profit for the space available.

The payback of a machine is easy enough to understand, but how the hit frequency affects an individual player lends itself to debate.

When a player plays slots, he will leave the game when one of the following happens:

1. He loses all money available
2. He wins a specific amount (exit criteria)
3. He must leave because of time constraints

Table 7.4 Different Machine Paybacks and Hit Frequencies

					Coins in one/two		Coins in one/two	
					Top	JP	2nd	JP
Strip	Max Coin	1st Coin	Hit Freq.	Stops	Award	Combos	Award	Combos
SS3375	95.058	(94.372)	12.777	64ABC	2K/5K	(1)	200/500	(26)
SS3376	92.550	(91.864)	12.390	64ABC	2K/5K	(1)	200/500	(26)
SS3377	91.058	(89.422)	12.337	64ABC	2K/5K	(1)	200/500	(26)

The player is trying to receive as much play time as possible. Therefore, how do machines with essentially the same payback react to players who leave the machine only when they lose all available funds or they win a specific amount?

If slot players were surveyed, many would be able to identify their favorite machine. These favorite machines are often called "loose" by the player. What makes a machine loose? From management's perspective, a loose machine is one that pays back a significant portion of the amount of coin-in invested. For example, few would argue that a 99.9% payback machine is loose by management's standards, but what if the machine had the following configuration:

Symbols	Reel 1	Reel 2	Reel 3	Reel 4
~	254	254	254	254
7's	1	1	1	1
Total	255	255	255	255

This machine has 4,228,250,625 possibilities. Assume the following payout schedule:

Payout Schedule	
7 7 7 7	$4,224,022,374

The jackpot only has one pay combination which is four 7's. When the 7's hit, the machine pays 99.9%. Is this a loose machine? By management's standards it would certainly be considered as such, but only one player will ever call this machine loose. The point is that something the player experiences results in the belief that the machine is loose. A primary factor influencing whether a player believes a machine is loose is the length of play that it affords. To prove this point, ten different IGT machines with essentially the same payback (i.e., 90%) but with hit frequencies varying from a low of 6.7% to a high of 29.6% were selected. Play was then simulated for these machines with different player starting banks and exit criteria. Each machine was a two-coin multiplier.

The simulation was structured to test the hypothesis that a machine with a high hit frequency yielded the most pulls per losing player. Three different scenarios were set:

1. Each player started with $100 and quit when $200 ahead.
2. Each player started with $100 and quit when $300 ahead.
3. Each player started with $200 and quit when $400 ahead.

If the hypothesis was correct, the average pulls per losing player should have increased as the hit frequency increased. Under the hypothesis, the player who wins is satisfied and will certainly believe that the machine is loose, but the losing player needs to experience long play time to feel satisfied.

The simulation did not prove the hypothesis. Instead, the results of the simulation left more questions unanswered. Figure 7.7 depicts the results of the simulation. The numbers inside the graph represent the percentage of players who lost their starting bankroll. Under the best scenario, 86.2% of the players lost! If so many players lose, management must focus on the losing players.

Increasing the percentage of payback will not necessarily increase the percentage of winning players. Machines can be ranked based on a "satisfaction index," which rates the machines by pulls per losing player. In this way management can offer high hold machines, but the players will perceive them as being loose.

RANDOM OR PSEUDO-RANDOM?

As discussed previously in this chapter, today's slot machine technology allows the symbol to be selected by computer rather than by mechanical selection as in the past. With modern stepper slots, motorized reels spin until they stop and display the symbols chosen by the computer. Is this selection by the computer a "random" selection? The answer to this question is no. The selection is not random since the computer must be programmed to choose the symbol to display.

Modern slots have an algorithm call a "random number generator" that selects a number and the number selected corresponds to a particular symbol. This algorithm is built into the computer's memory. The following is an elementary random number generator:

$$6z \bmod 13$$

where z = 1st the seed and then the last number generated
mod = the remainder of, in this case, 6z divided by 13

This random number generator will generate a series of 13 "pseudo-random" numbers before it repeats itself. The generator must first be "seeded." Typically, the seed is a number chosen by the computer's internal clock. In the above example, the seed will be the number 1.

$$6 \times 1 \bmod 13 = 13\overline{)6} = 0 \text{ with a remainder of } 6$$

Therefore, the first pseudo-random number selected by this generator is 6. The six then becomes "z" for the selection of the next number.

$$6 \times 6 \bmod 13 = 13\overline{)36} = 2 \text{ with a remainder of } 10$$

agement. These guidelines must encompass both the profit objectives of the casino and customer expectations.

SLOT RATING SYSTEMS

The focus of this chapter has been on player rating systems specific to the table games area. The primary reason for the increased focus on this area is the diversity that exists in the games and the subjectivity in the determination of many of the player rating criteria by casino floorpersons. The rating of slot customers for the issuance of complimentaries and for casino marketing purposes is also very important to the success of the casino operation.

As opposed to table games ratings which are prepared manually and then must be input to the computer system, most casinos today have computerized rating systems in place which provide for automated rating of slot players. The slot player inserts a personalized card, much like a credit card in appearance, into the slot machine that she is playing. The card identifies the player to the slot computer system and initiates the tracking of the player's wagers (coin-in), payouts or accumulated credits and the time played.

Players may move between machines while continuing to be rated since the slot machines are linked to a central computer which recognizes and tracks the customers' play wherever they are in the casino as long as they continue to insert their cards. Many systems today are also capable of identifying slot customers playing at predetermined levels who are not using a card and, as a result, are not being rated by the system. The slot computer system identifies these players for slot marketing personnel through a computerized map of the casino floor. This may be used to approach the players and offer them the benefits of obtaining a personalized card.

Complimentaries are determined by the slot rating system based on the accumulated play of the slot customer. The system takes the total coin-in of the player and multiplies it by the theoretical hold percentage of the specific machine or a weighted average of the theoretical hold percentage for a specific type of machine in order to determine the total earning potential (theoretical win) derived from the player. Based on criteria determined by management and competition, a pool of points or dollars is accumulated by the customer which may be converted into complimentaries at the casino and, in some cases, may be converted into cash.

As long as the system is functioning properly and the criteria used by management for determining the rate at which complimentaries are awarded is used properly, the slot rating system should maintain a high degree of accuracy. Statistics reflecting complimentaries awarded as a percentage of rated play can be used by management to monitor the performance and effectiveness of the slot rating system.

Chapter
13

Table Game Hold as a Management Tool

USES OF TABLE GAME HOLD

Table game hold is probably one of the least understood but historically most misused tools available to casino management. In the past, table game hold had two primary uses: (1) to identify good or bad casino management and (2) to identify theft. It was not so long ago that the integrity of an individual dealer or even an entire shift of casino personnel was determined by the hold percentage maintained by the dealer or shift.

Even today, hold is often used by management in making decisions on whether employees are honest and productive. In 1983, the Las Vegas Hilton fired 37 long-time casino employees because the shifts on which they worked were experiencing what management felt was an abnormally low hold percentage. The terminated dealers subsequently filed a wrongful termination suit and were awarded over $37 million in actual and punitive damages. Fortunately for Hilton, the punitive damages, which represented the largest portion of the award, were thrown out on appeal. This example highlights the importance placed on table game hold by management.

In its simplest form, table game hold represents the percentage of chips purchased at the table by the customer that is won back by the house. Mathematically, the formula for hold is:

$$\frac{\text{win}}{\text{drop}} = \text{hold}$$

If hold is to be used as a viable management tool, management must thoroughly understand its determinants and limitations.

DETERMINANTS OF HOLD

Rim Sheets If permitted internally by casino management, Nevada casinos may use rim sheets (also referred to as auxiliary table cards or premarker tally sheets) in lieu of preparing markers at the time credit is issued to the patron. Rim sheets are only available to the casino's biggest players and are most often used in baccarat; however, rim sheets may also be found in craps, blackjack and roulette.

The average customer who wishes to play the table games must first purchase chips and then proceed to play. When rim sheets are in use, the player plays first and then purchases his chips, which is the reverse of what the average customer experiences. A floorperson records the total amount of credit a rim sheet player has received during a session of play.

At the termination of play, the player signs a marker for the total amount of credit outstanding. Since the marker signed usually represents only the amount owed, the casino will hold 100% of the rim sheet play. With this privilege afforded to only the biggest players, the baccarat hold and the overall hold in general can be dramatically affected.

Graveyard Shift and Hold The shift which generally has the highest hold percentage is graveyard. Why does this occur? The higher table hold percentage is not primarily attributable to the quality of employees working during graveyard shift, but rather to the timing of when the games are counted.

Graveyard shift will generally relieve the swing shift between 2 and 4 a.m. When the table inventory count is performed, the games will have a large number of customers still playing. When the table drop boxes are removed following the inventory count, graveyard starts their shift with the largest number of customers they will entertain all shift, and these players already have chips in their possession which they purchased on the prior shift. In the hours following the arrival of the graveyard shift, the number of customers playing in the casino usually declines dramatically. The graveyard shift hold percentage benefits directly from the inheritance of the chips held by the swing shift customers while not being impacted by their chip purchases.

The effect on the hold percentage is much the same as sending the players to the cage to purchase their chips. Graveyard shift benefits on the numerator side of the hold formula (win) while the denominator (drop) is not proportionately influenced. If management wanted to decrease the hold percentage for graveyard shift, the start and count times could be changed to the hours of the morning with the least customer activity.

Foreign Gaming Chips Foreign gaming chips are chips received from other casinos. The procedure for treating foreign gaming chips can affect

hold if the casino policy is such that foreign chips are not allowed to be placed in the table drop box, but are instead placed into the chip tray (float). The table hold percentage can be expected to be greater if the foreign chips are placed into the float since under the alternate policy they would become drop once placed into the drop box.

Some casinos have special cheques in baccarat and the race and sports book. The same rule applies to these cheques. If the cheques are allowed to be dropped, the table hold percentage will decrease. Maintaining the cheques in the float increases the hold percentage.

Marketing Programs Casinos today offer a myriad of marketing programs. The nature of programs offered can impact the table hold percentage. For instance, the use of match play coupons, nonnegotiable gaming chips and chip warrants will affect hold. These programs, which are discussed in greater detail in a later chapter, have the same effect as taking money out of the chip tray and handing it to the player. Coupons or chips placed into the table drop box under these programs results in decreases to win.

Some casinos award thousands of dollars daily in these type of giveaways. In addition, many casinos now offer $5 table game programs where a player must play a minimum number of hours at a required minimum bet to receive a complimentary room and food discounts. Players whose intent is to merely qualify for the promised discounts will generate chip purchases (buy-ins) more approximate to their play; consequently, the table hold percentage will be greater than for players at the same level whose play is unrelated to any giveaways.

Marker Collection Policy The casino's policy relating to the collection of marker payments at the tables can affect hold. A casino with a policy that provides for any amounts owed to be aggressively collected prior to the player leaving the game will hold more than a casino where the policy is the opposite. Players allowed to walk away from the table without paying may choose to obtain more markers than necessary resulting, in some cases, in the casino providing the player with an interest-free loan.

In many gaming jurisdictions outside of Nevada, marker payments can only be made at the casino cage. The marker is transferred from the table to the cage and the customer pays the amount owed at the casino cage. Some other jurisdictions such as Nova Scotia, Canada, do not permit the issuance of gaming credit to customers. These and other differences in the operation of the casino must be taken into account when comparing table hold percentages for casinos in different jurisdictions.

Table Utilization Table utilization relates to the number of customers occupying the seats at a gaming table. Higher table utilization rates result in lower table hold percentages. To illustrate this, assume that eight play-

ers walk into a casino at the same time with the same amount of money ($100 each) and all plan on betting $10 per hand for one hour. One player sits alone and the other seven players sit together.

	Table 1	Table 2
Players per table	1	7
Drop per player	$100	$100
Total drop	$100	$700
Bet per hand per player	$10	$10
Total bet per hand	$10	$70
House advantage	1%	1%
Hands per hour	209	52
Win per hour	$20.90	$36.40
Hold per hour	20.9%	5.2%

The casino's payroll decreases as demand more closely matches supply; however, the end result could be a lower hold percentage. If all of the players above were betting $100 per hand, management would prefer to provide one dealer for each player. Unfortunately, the majority of casino customers fit into the lower end of the betting spectrum and require a higher utilization to justify the opening of the game. Maximizing dealer productivity yields the lowest hold percentage.

As the average bet increases, the optimum table utilization decreases. A casino trying to maximize the average number of players at all games, regardless of the minimum bet, is generating the highest profit margins, but less net profit than if fewer players were at each game.

Cash Wagers The policy toward the betting of cash on the table can also influence the hold percentage. In Atlantic City and many casinos throughout the world, cash wagers are not accepted. In these jurisdictions, all cash must be exchanged for chips before placing the wager. Other jurisdictions such as Nevada allow wagers to be made using cash.

For casinos allowing cash wagers, the money is only dropped in the table drop box if the wager is lost. Consequently, casinos that allow the wagering of cash hold a higher percentage than those casinos where cash wagers are not permitted. Consider a game with a 2% house advantage—the casino wins 51% of the wagers and loses 49%. At the end of 100 cash wagers, only 51 of the wagers become drop. If cash is not allowed to be wagered, all 100 wagers become drop, resulting in the same win, larger drop and a lower hold percentage.

Even in casinos permitting money play wagers, the policy for handling these wagers can impact the hold percentage. If the policy is to exchange any money-play wager from cash to chips prior to the payoff, the casino can expect to hold a lower percentage than a casino where the policy is to leave the cash on the layout. The policy of converting the cash to chips prior to the outcome of the hand should result in greater play for the casino than the alternate policy since the customer is given chips to continue his play instead of returning his cash in the event of a winning wager. Management in many casinos continues to focus on maintaining a higher hold percentage even if it may result in a lower net win.

THEORETICAL WIN AND HOLD

Next, the impact that total win has on the hold percentage is considered.

Win = Average Bet × Hours Played × Hands per Hour × House Advantage

The average bet can affect hold percentage primarily through the player's bet to buy-in ratio which is derived from dividing the average bet by the amount of the initial chip purchase (buy-in). With all the variables remaining equal, the player who buys-in for $100 and has an average bet of $1 will lose one-fifth the amount of the player with the same buy-in, but with an average bet of $5. In the latter case, the casino's hold percentage will be five times that of the $1 bettor. Management refers to the situation where a player's average bet is extremely small in comparison to the accompanying drop as false drop.

Management can also increase or decrease the hold percentage through any policy that affects the total hands or time played. For example, assume that a casino has decided to change its shuffling and dealing procedures such that each six-deck shoe in blackjack is shuffled after only one hand is dealt. If this were the case, management would find that they still receive the drop, but that the total win will decrease markedly because the players will become disillusioned as a result of the game's slow pace. With the win decreasing and the drop remaining basically unchanged in relation to the bet to buy-in ratio, the hold percentage will be extremely small.

Just as frequent shuffling can affect the hold percentage, increasing the shuffling time can also affect hold. In the past few years, a method of blackjack play known as *ace location* has generated much concern by casino operators. An ace locator is a player who tracks the aces in a less than thoroughly shuffled shoe. Once the player knows when an ace is likely to be dealt, he increases his bet substantially in an attempt to catch this ace.

If successful, the player has an advantage exceeding 50% on the hand where the ace appears. Many ace locators have developed considerable

expertise; however, casino management has instituted shuffling methods that involve very complex and lengthy shuffles. Any shuffling after the cards are thoroughly mixed results in lost revenue and a decrease in the hold percentage. Management should pay particular attention to the shuffling procedure and the time required to accomplish the shuffle.

Even the type of seating selected by casino management can affect hold percentage by increasing or decreasing the time played. It is possible to hold 100% if the player were to sit at the table long enough. A few years ago, a major casino in Las Vegas had chairs at their blackjack tables that were, undoubtedly, the most uncomfortable and difficult to sit at in Las Vegas. The chairs fit the decor, but failed to provide an acceptable comfort level to the customer. It was not uncommon to walk through this casino and find as many as one-third of the blackjack players standing. Anything the casino does to shorten the playing time will decrease the total win without substantially affecting drop, thereby decreasing the overall hold percentage.

House Advantage Probably the most significant determinant of hold percentage is the house advantage or player skill level. The house advantage will affect win and ultimately impact the hold percentage. Anytime management increases or decreases the house advantage, the total win can be expected to change accordingly if the other variables in the win formula remain constant.

What would be the effect on hold percentage if a casino were to decrease its blackjack advantage by changing from a six-deck shoe to a one-deck game or to decrease its craps advantage by offering triple odds as opposed to single odds? It could be argued, but not empirically supported, that decreasing the advantage will result in the average player either playing longer or increasing the average bet to the point that the prior win total will equal or exceed the win total after the change. If this argument were true, the hold percentage would remain unchanged.

The relationship of advantage-per-hand to hold percentage is linear (i.e., as one increases, so does the other) and Figure 13.1 demonstrates this relationship. The 1986 Atlantic City statistics for the games of baccarat, roulette and big-six will be used to illustrate this linear relationship (see Figures 13.2 to 13.6). Baccarat, roulette and big-six are the games least affected by player skill level and all three games had the same number of decks, odds and rules in 1986. It is generally accepted that the average house advantage-per-hand in these games approximates 1.15%, 5.26% and 18.8%, respectively.

If management increases the house advantage, hold percentage can be expected to follow. The amount of increase or decrease cannot be predetermined; however, the hold percentage moves in the same direction as the game advantage.

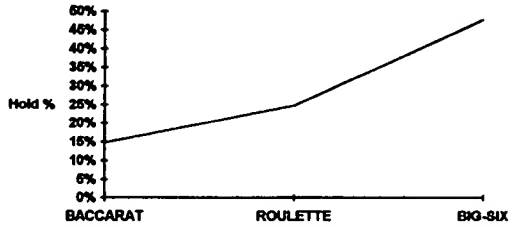


Figure 13.1 Relationship of Advantage-Per-Hand to Hold Percentage

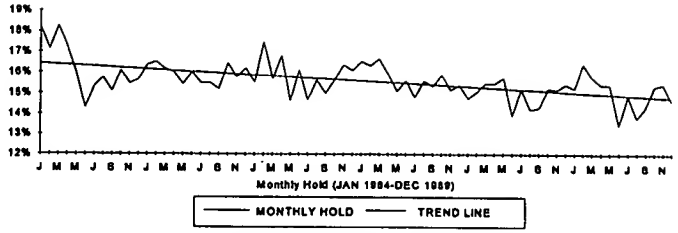


Figure 13.2 Atlantic City Blackjack Hold Trend Analysis, All Casinos

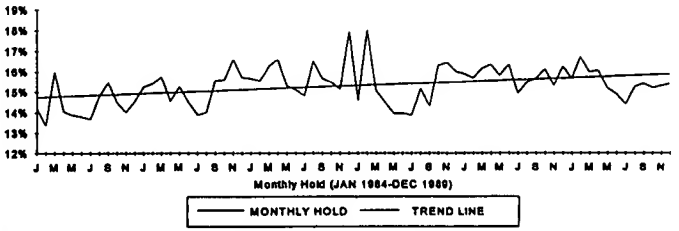


Figure 13.3 Atlantic City Dice Hold Trend Analysis, All Casinos

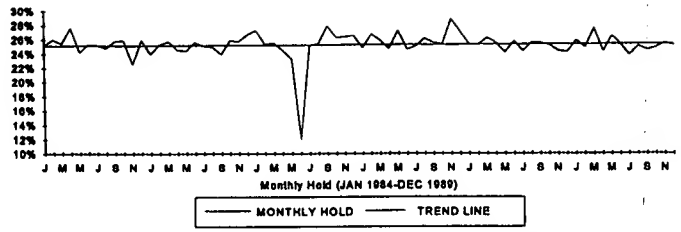


Figure 13.4 Atlantic City Roulette Hold Trend Analysis, All Casinos

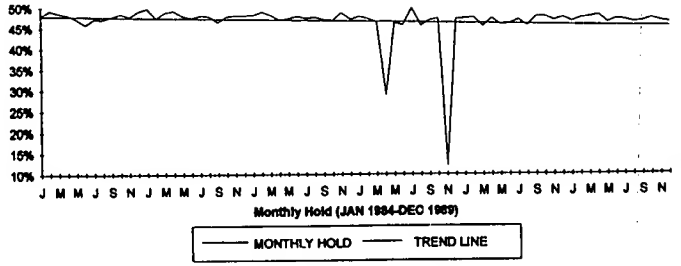


Figure 13.5 Atlantic City Big-6 Hold Trend Analysis, All Casinos

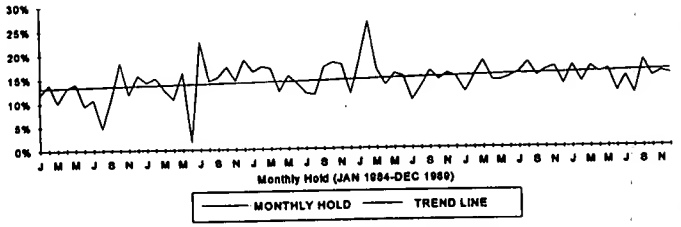


Figure 13.6 Atlantic City Baccarat Hold Trend Analysis, All Casinos

Hold Objective If a game with a house advantage of 1% is to hold 20%, the total amount wagered must equal 20 times the buy-in. If the buy-in is $100 and the house earns 1% of the total wagered, a win of $20 would require the total wagered to equal 20 times the $100 buy-in ($100 × 20 = $2,000 and $2,000 × 1% = $20). The formula for determining the buy-in and total wagers required to achieve a desired hold objective follows:

$$\frac{\text{hold objective in percent}}{\text{house advantage per hand}}$$

Using this formula, a game holding 25% and with a house advantage of 5.26% (as in roulette) would require wagers totaling 4.75 times the buy-in to generate the actual hold percentage (e.g., a $25 win is the result of a $100 buy-in and $475 in wagers).

Effect of "Hits" on Hold Almost every casino keeps in each gaming pit a record of large player wins or losses. The Mirage might use $10,000 as the threshold for recording large wins and losses, while the Sahara might only record "hits" of $2,500 or more. These documented hits represent play that several casino executives and, in many cases, surveillance personnel observed. As a result, management is confident that the hits were derived from "clean" player transactions and serve only to skew the casino data since they represent player wins and losses outside of the norm.

Exceptionally large player losses make the hold percentage look unusually good, while exceptionally large player wins make the hold look unusually bad. If management is to use hold as a tool, these large hits should be removed from the casino results. To accomplish this, the drop for a player who won a large amount should be subtracted from the total drop and the amount the player won should be added back into the casino win. If a player loses a large amount, the player's drop should be subtracted from the total drop and the amount of the loss should be subtracted from the casino win. Note that the drop is subtracted regardless of the player outcome.

Some factors are less significant than others, but can still seriously distort the hold percentage and its usefulness as a management tool when they are considered in the aggregate. The determinants addressed above should be carefully considered before any final determination is made concerning hold. Hold can be calculated from

$$\text{hold} = \frac{\text{win}}{\text{drop}} = \frac{\text{average bet} \times \text{hours played} \times \text{hands per hour} \times \text{house advantage}}{\text{drop}}$$

where

Average bet is a factor of the bet to buy-in.

Hours played is a factor of customer service and player comfort.

Hands per hour is a factor of dealer efficiency, the speed of the game (which is a factor of the shuffling procedure and sweat card location) and table utilization.

House advantage is a factor of the player skill level and rules in place.

Drop is a factor of the foreign chip policy, betting of cash policy, false drop, marketing programs, and the use of rim sheets.

HIGH TABLE OCCUPANCY MAY BE HAZARDOUS TO PROFIT

Casino management is under constant pressure to increase profits, and casino profits equal *win* less *expenses*. As a result, emphasis is often placed on decreasing expenses in order to create additional profit. The table games department payroll represents 25–50% of the game's win and is the largest line item on the casino's Profit & Loss statements (P&L). When it comes to decreasing expenses, payroll appears to be the most obvious place to begin cutting.

The casino has two primary types of expenses: (1) expenses directly related to the number of customers (i.e., complimentary beverages, gaming taxes, etc.) and (2) payroll expense which is indirectly related to the number of customers, but directly related to the number of games open. Each open game must have a dealer(s), floorperson and boxperson (dice only) whether the table is full or empty.

How does the number of players at a table affect the decisions per hour? Table 13.1 shows the correlation between players per table and decisions per hour.

As discussed previously in this chapter, shuffling procedures, the sweat card (a plastic card used to indicate when the cards are to be reshuffled) placement and the number of decks used can change these productivity figures, but any procedure that affects a full table also affects heads-up (one-on-one) play. Consequently, the same linear correlation applies for all levels of table utilization.

Imagine that the president of the company walks through the casino and observes 28 blackjack tables open, but each table only has one player wagering $100 per hand. What conclusion will likely be drawn based on this observation? It is not difficult to deduce that a directive will soon be issued from the president's office to reduce the number of blackjack tables that are open. Instinctively, this reaction appears sound since salaries and wages represent a relatively high portion of the table game department's expenses. Is this the correct response by the president? Will fewer games open with the same total number of players lead to maximum profit?

Table 13.1 Correlation between Players per Table and Decisions per Hour

No. of Players	*Avg. Blackjack Hands per Hour*[1]
1	209
2	139
3	105
4	84
5	70
6	60
7	52
No. of Players	*Avg. Dice Tosses per Hour*[2]
1	249
3	216
5	144
7	135
9	123
11	102
No. of Players	*Avg. Roulette Spins per Hour*[3]
1	112
2	76
3	60
4	55
5	48
6	35

[1] From a study conducted in an Australian casino where seven decks of an 8-deck shoe were dealt before shuffling.
[2] From a 1990 study conducted in an Atlantic City casino.
[3] Ibid.

To analyze this question, some assumptions regarding staffing and payroll costs must be made. The assumptions follow:

- One dealer per table working 60 minutes on and 20 minutes off
- One floorperson per four games (0.25 floorperson per game) receiving one 60-minute and two 20-minute breaks each shift
- Each dealer is paid $50 per eight-hour shift
- Each floorperson is paid $150 per shift
- Taxes and benefits equal an additional 30% of actual labor costs

The payroll costs vary with the number of games open, while costs such as complimentary beverages and gaming taxes are a function of the total number of actual players.

Using these assumptions, the following demonstrates the cost to staff each table for eight hours.

$$\text{Dealer} \quad \frac{80}{60} \times 50 \times 1.30 = 86.67$$

$$\text{Floorperson} \quad \frac{480}{380} \times 0.25 \times 150 \times 1.30 = 61.58$$

Total Labor Per Table **$148.25**

Table 13.2 compares two scenarios: one player per table at 28 tables, and seven players per table at four tables. First, an average bet and house advantage must be assumed. An average bet of $100 per hand and a 1% house advantage will be used. The house advantage does not affect the outcome of the scenarios, and the impact of different sizes of bets will be discussed later.

In the comparison given in Table 13.2, margin increases as occupancy (utilization) increases, but profit decreases. Consequently, the following shows the correlation between occupancy, hold, margin and profit.

Occupancy⇑ Hold⇓ Margin⇑ Profit⇓

When management attempts to put the same number of players on fewer games (i.e., increase occupancy), the return on labor is successfully increased, but the primary objective of maximizing profit is not achieved. As the comparison above illustrates, efforts to increase game occupancy will result in the reduction of profit.

Table 13.2 Costs of Staffing Tables

	Scenario 1	*Scenario 2*
Tables open	28	4
Players per table	1	7
House advantage	1%	1%
Bet per hand per player	$100	$100
Hands per hour	209	52
Win per hour per table	$209	$364
Win per table per shift	$1,672	$2,912
Gross win (all tables)	$46,816	$11,648
Labor cost per table	$148.25	$148.25
Total labor cost all tables	$4,151	$593
Contribution	$42,665	$11,055
Margin (%)	91%	95%

Management often is in the position of determining reasons for declines in the hold percentage. If average occupancy has increased from 3 to 3.8 players per game, the increase in occupancy will, in itself, decrease the hold percentage. The increase in the average occupancy will result in an increase in the margin of the table games department, but decreases in profit will also be experienced.

The casino must have a high table occupancy at certain average bet levels in order for the resulting win to cover the associated labor cost. In the preceding example, it cost $148.25 in labor to keep a game open for eight hours, which equates to $18.53 per hour. At a Nevada tax rate of 6.25% and a 1% house advantage, the casino's gross win will be 93.75% of 1% (0.9375%). At 52 hands per hour at a full table, the following shows that each player must have an average bet of $5.43 for the game to cover the cost of labor and taxes.

$$52 \times 7 \times 0.9375\% \times Y = \$18.53$$
$$3.4125Y = \$18.53$$
$$Y = \$5.43$$

Table 13.3 shows the number of players and average bet needed to achieve the same break-even.

At smaller average bets, the table must be near maximum occupancy if the game is to break even. As the average bet increases, fewer players per game will generate the most profit. Although the above analysis deals with blackjack, the same principles apply to all table games.

The blackjack hands per hour indicated above assumes seven decks dealt from an eight-deck shoe before reshuffling occurs. The hands per hour is acutely sensitive to the number of decks used, shuffle time and the number of decks dealt before shuffling. For instance, the casino will deal less hands per hour if only six of eight decks are dealt before reshuf-

Table 13.3 Minimum Break-Even Bets

No. of Players	*Avg. Blackjack Hands per Hour*	*Minimum Bet Necessary to Break Even*
1	209	9.46
2	139	7.11
3	105	6.27
4	84	5.88
5	70	5.65
6	60	5.49
7	52	5.43